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THE
YOUNG ARITHMETICIAN'S
GUIDE
TO
A KNOWLEDGE OF NUMBERS;

BEING AN

EASY PRACTICAL SYSTEM

OF

ARITHMETIC,

Explained and brought down to the capacity of the Learner;

ADAPTED TO THE CURRENCY OF THE UNITED STATES.

BY THOMAS W. CONKLING,
TEACHER.

NEW-YORK:
PUBLISHED BY KETCHAM & AYMAR.
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RECOMMENDATIONS.

Fr[illegible] the Rev. Wm. Belden, a classical teacher in the city of New-York.

New-York, January [illegible]

[illegible]ar Sir,—I have examined the manuscript copy of your new Arithmetic, with as much attention as my numerous engagements would admit; and have no hesitation in saying, that it appears to me decidedly superior to every other system with which I am acquainted, in rendering the science both pleasant and easy to learners, especially those of an early age. The method which you have pursued in developing the principles and the general process under each rule is such, that with due attention, the learner will be able to pursue this important science understandingly, with little, or no assistance from the teacher. In this respect, the work will be found a valuable [illegible] not only to learners, but to teachers also; [illegible] much labour in the way of explanation, and enabling them to devote more of their time and attention to other duties of the school. That you will meet with merited success in this publication, is the ardent wish of,

Sir, your obedient servant,

Mr. Thomas W. Conkling. WILLIAM BELDEN.

From Mr. S. Hammond, teacher of Public School, No. 4. and from Mr. George Everitt, teacher of Public School, No. 12.

Mr. Conkling, New-York, 2d Feb. 1831.

Dear Sir,—Agreeably to your request, we have given the manuscript copy of your Arithmetic, as attentive a perusal as the hurry of business and occasional interruptions would permit; and do not hesitate to express a favorable opinion of the performance, especially for beginners, and those who may be under the necessity of resorting to self-instruction, in that useful branch. We wish you much success in its publication.

GEORGE EVERITT,
S. HAMMOND.

From Aaron M. Merchant, Esq. late principal of Union Hall Academy, author of the "American School Grammar," &c.

Mr. T. W. Conkling, New-York, Feb. 15, 1831.

Sir,—I have examined your new Arithmetic in manuscript, with as much care as the limits of my leisure would allow. Your plan of arrangement is certainly good, the illustrations simple, and well calculated to arrest the attention, and facilitate the progress of learners; and the tables, to say the l
nious. I think your arrangement an improveme
other that has fallen under my observation.

ther merit which your Arithmetic has, which is certainly a *desideratum.* It is not a patchwork of those numerous publications, which have been turned out of the hands of compositors upon the world, since the days of Dilworth: so far as I have seen, its questions to exercise the mind of the student, are *original.* Were I, as I have been, engaged in the instruction of youth, I should feel it my duty to introduce your Arithmetic, not to the exclusion of others, but in connexion with them, for in so doing, I am confident it would save me much labour in writing new exercises. I sincerely hope that you may receive ample reward for your labour, in preparing it for the press.

Respectfully, I have the honour to be yours, &c.

A. M. MERCHANT.

From Mr. Jared B. Peck, teacher of a select English School.

Mr. Thomas W. Conkling,

SIR,—I have *partially* perused the MS. of your "Young Arithmetician's Guide," &c. and was much pleased to see each *compound rule* immediately preceded by its appropriate table, which I consider important. Your examples for illustration are also well calculated to impress the *principles* of the rules upon the scholar's mind, and cause him to *think* for himself, without which, "the young arithmetician" will never become a *practical* one. Wishing you success in your attempt to benefit the young student in a *very important branch* of education, I shall introduce your Arithmetic into my school as soon as published.

Respectfully, your friend,

New-York, April 2, 1831. J. B. PECK.

From Mr. Joseph McKeen and Mr. T. Whitlock, principals in Union Hall Academy.

Mr. T. W. Conkling,

SIR,—We have examined the Arithmetic which you propose to publish, and are of opinion that it is in some respects preferable to any in use. Without pretending to have made any new discoveries in the science of numbers, you appear to have followed the models that have the sanction of public approbation. The blanks, which you have left in your directions for an operation, requiring the learner to determine, from the nature of the question, what elementary rule must be applied, are calculated to develope the reasoning faculties; and it appears to have been your aim, to elicit thought. Many very able scientific writers on this subject, have been less successful in this particular. We *have no doubt* but your book will come into honourable rivalry th *the best in use.*

lemy, } JOSEPH McKEEN,
T. WHITLOCK.

From the Rev. Thomas McAuley, D.D. L.L.D. late professor of Mathematics in Union College.

Mr. Thomas W. Conkling, Philadelphia, July 19, 1831.

Dear Sir,—I have read with great pleasure, your interesting *Elements of Arithmetic*, and am fully of the opinion that it will be a very profitable book for the use of those who are beginning that interesting branch of science, a branch which every child should be made familiar with. I think there is a charming simplicity, and natural order, and harmony, maintained through the whole treatise, which could not have been obtained otherwise than from your long experience in teaching, and your good sense in observing; and which cannot fail to secure the approbation of all who are in the habit of instructing children, as soon as they become acquainted with it. I think your book will help both the teacher and the pupil, and make the labour light and pleasant. I would have been pleased to have seen more examples for practice appended.

I am very sincerely and affectionately,
Your friend and servant, THOMAS McAULEY.

From the Rev. William McMurray, D.D.

As far as I have been able to examine *The Young Arithmetician's Guide*, by Mr. Conkling, I fully accord with the preceding opinion of Dr. McAuley. Wm. McMURRAY.
New-York, July 21, 1831.

From Mr. John Gould, principal of the Japhian School.

Mr. T. W. Conkling, New-York, July 21, 1831.

Sir,—I have examined your new Arithmetic, which you left me in sheets, with as much care as my other calls would admit, and have formed a very favourable opinion of its merits. The arrangement and exemplification of the various rules meet my entire approbation; and the directions for solving the questions, (which are nearly all original,) are well calculated to relieve the teacher from so frequent application, by directing the scholar to your copious and well-arranged tables. To test their utility, I gave the book to one of my pupils, ciphering in Reduction, who was unusually puzzled to know when to divide and when to multiply, and by what, and was confirmed in the opinion I had formed of their usefulness. I need not say I shall introduce it into my school immediately after vacation. Hoping you may be rewarded for your labour,

I remain yours with respect, JOHN GOULD.

From the Rev. John M. Krebs.

Mr. Conkling,

Dear Sir,—If, after the very hasty glance, which I have had time to bestow upon your book, I may be

(as you desired me,) to express an opinion of its merits, I do not hesitate to say, that that part of its *plan* which most attracted my attention, seems calculated to afford benefit to both teachers and scholars. By inducing the latter to *think* for themselves, you do them an especial service; and this you do, by furnishing them with ample materials and facilities in the numerous *examples* and *guides* which are given under every rule. The student is here excited to enquire and experiment for himself, by the very spirit of philosophy, the desire of discovering truth, and is led on from attainment to attainment just because he has light enough afforded to *assist* him in the search, and is rewarded for his *intelligent* pursuit by the knowledge which *he* has attained for himself. In this enquiring age he who imparts that information which either unfolds or tends to discover the "*How*" and the "*Why?*" is just so far a public benefactor. This appears to be the main object of your book, and I hope therefore that public approbation will adequately reward you for the pains which it has cost you.
Yours, &c.

New-York, July, 1831. JOHN M. KREBS.

From the Rev. Elihu W. Baldwin.

Mr. Thomas W. Conkling,

Dear Sir,—I have examined with considerable care and much interest the "Young Arithmeticians Guide," the plan and arrangements of the work are such as will afford new and substantial aid to the learner, with some experience in the instruction of youth, I am free to say that I should prefer it to any Arithmetic with which I am acquainted.

Yours Sincerely, ELIHU W. BALDWIN.

From Mr. Benjamin F. Hart.

Mr. Conkling, New-York, July 23, 1831.

Sir,—Your son handed me your work on Arithmetic. for examination. To test its usefulness, I placed it in the hands of two of the small boys of my school, one aged 8 and the other 10 years, requesting them to begin at reduction, corresponding with the rule they cipher in, and to read and observe the instruction contained therein, and to do as many sums as they could, without my assistance, in four hours. The result stands as follows: they worked out 189 *sums* in the given time, I was astonished at the ease and alacrity with which they advanced, this was owing to the simple and well arranged notes and instructions contained, as they advanced, under each question. There was no difficulty on their part whatever, in understanding every thing connected with the sub-[illegible] [illegible] tables are all admirably arranged, and completely [illegible] capacities of small children. I am of opinion, sir, that the copious and well arranged rules, examples, observations, notes, and simple instruction, contained in your work, places it beyond doubt as one of the most useful books to facilitate the knowledge of Arithmetic, that has come under my observation. It is, also, well adapted for the use of monitorial schools, from the many short and simple notes and explanations following the sums of each rule, which cannot fail of giving such ideas and information as tend to remove the usual difficulties experienced with small children, in simplifying the rules to their comprehension, and elucidating the subject in a clear and simple manner. I wish you much success in your undertaking, and from my knowledge of your great experience as a practical arithmetician for the last sixteen years, I hesitate not, to say, you have accomplished for the rising generation, a work on Arithmetic, which cannot but be extensively used as it is made extensively known. Very respectfully,

BENJ. F. HART,
Principal of N. York Public School, No. 3, Greenwich.

From Mr. Joseph Belden.

Mr. T. W. Conkling,

DEAR SIR,—I have perused with much pleasure and satisfaction, a treatise on Arithmetic, which you have recently published, and can cheerfully recommend it, as a work well adapted to the improvement not only of those who are taught according to the system of monitorial or mutual instruction, but of young learners universally. I have been particularly pleased with your explanatory notes, which are calculated, in an eminent degree, to facilitate the acquirement of a knowledge of Arithmetic; and also, to relieve the teacher of much labour in this branch of instruction.

JOSEPH BELDEN,
Teacher of N. York Public School, No. 11.

From Mr. Amos W. Brown.

I have examined an "*Arithmetic*" compiled by Mr. Conkling, of this city, and believe it to be, in some respects, preferable to any I have yet seen. The practical exposition of the tables, in the commencement of Reduction, and the familiar explanations attending almost every example under each rule, seem to be well calculated to assist the scholar in his progress through the book; and, consequently to relieve the teacher, very much, from that constant oral explanation, which is required of him by the pupil, in the application of the rules and tables.

July 25, 1831. **A. W. BROWN,**
Teacher of the senior department of G. Y
Academy, No. 374, Pearl st. N.Y

PREFACE.

To attempt the publication of a new arithmetic, when there are so many extant, may seem superfluous; and therefore, require something said by way of apology, for adding another to the number already before the public; but where there is a manifest improvement in any science, a generous public will deem it sufficient; as such, this is presented to the candid examiner, with a full conviction, that upon a careful perusal, he will unite with the author in opinion, that an arithmetic upon the plan pursued in the following pages, is not only judicious, but much needed. To take up time and weary the patience of the reader with a long introduction, is not intended; I shall therefore, only touch upon a few outlines of the work, and submit it to the public.—In the commencement, I would simply observe, that this arithmetic has been compiled for the pupil, and the great object has been to simplify it so as to meet his capacity, and thereby enable him to advance to a knowledge of numbers without that assistance from his teacher which the various methods now in use require. During a long course of years spent in the instruction of youth, I have used many systems of arithmetic, and have generally found them so far above the student's comprehension as to require a considerable part of the teacher's time, to explain to him the rules &c. not only the rules, but many questions in the same rule, though solved by the method require a process so different as to bewilder the scholar and leave him so much in the dark as to need the assistance of his teacher to help him forward. And to every person acquainted with the education of youth, it may appear evident, that the teacher, (however attentive he may be,) is not, at all times, at leisure to give the scholar that information his understanding may require; and, even if it be admitted that the teacher is at all times ready to explain and solve the many difficulties that are continually presenting themselves in some form or other to the mind of the learner, and though he does it, perhaps, in a few minutes, it is forgotten, or, may be, he did not comprehend the explanation: the consequence is, his work becomes irksome, and he concludes, that if he must be making inquiries at the commencement of each rule and perhaps, at many questions in the same [illegible] er will make an arithmetician. Thus, the l. [illegible] h time, makes but little progress and understands but little that he passes through. The system now presented is intended to remove or obviate these and many other difficulties that lie in the way to a knowledge of numbers. In the arrangement of the rules, attention has been paid to place them in the best possible manner for the regular advancement of the pupil; but, as teachers differ in opinion with regard to the rules which ought to be introduced first, no arrangement to please all, can be laid down. This difficulty can be removed; for, whoever prefers another method can make his own selection by introducing that rule first that he, in his judgment, may deem proper. It has been one principal object of the compiler to make every part plain and easy to be understood, by giving as concise a rule, as the case would admit; illustrating the same with an example worked at large with the method of doing each part of it, and the reason why it is so done. Under every question where it appeared evident that the learner would have any difficulty, he is instructed how to proceed; and it is so adapted to his capacity, that his progress becomes a pleasure, rather than a task. I would here say, that to give all the questions with their several operations, appears to be as great an error, as giving the examples above the scholar's capacity, without an explanation. To enter into a particular detail of all the rules would be tedious, and perhaps unnecessary; I shall therefore, close with a few general observations. The work is commenced with Numeration, Simple Addition, Subtraction, &c., each of which is rendered as plain as the nature of their operations seemed to admit. With Compound Addition, Federal Money is introduced, although performed like whole numbers, the reason for so doing is, its having different denominations, and will, therefore be better understood. In most of the rules examples are given, both in Federal and Sterling money, and the whole rendered so plain by explanations, &c. that a child of common abilities may progress with but little assistance from his teacher. The examples in the rules of reduction are so arranged, that the learner may work out the process without assistance, by examining the rules, tables, &c. These tables are so constructed, that the learner may in general know what to multiply or divide by, to reduce or bring one denomination into another, and also the reason why. For example suppose 34£ be given to be reduced to farthings; under the question it reads thus: pounds multiplied by——are shillings; shillings multiplied by——are pence; pence multiplied by——are farthings. The scholar reads pounds multiplied by ——are shillings; the question immediately arises by what? If he be at a loss he refers to the table of money, and finds th reads, pounds multiplied by 20 are shillings, because 2 lings make a pound; shillings multiplied by 12 are pence, because &c. here the learner knows what to do, and the reason why he does it in this manner; I have passed through the rules of reduction. After reduction of money, weights, measures, &c. reduction of currencies is inserted; the reason for so doing, is, because many scholars have not time to go through all the the rules, and as it is necessary for every one to know something of them, a few examples are here given, and they are again treated of, after Decimal Fractions. The rule of Three Direct and Inverse, Practice, Tare and Trett, Interest, &c. are rendered as plain as their nature seemed to require, by notes, and explanations, which are intended to induce the learner to exercise his own judgment, or, in other words, to think and act for himself. With Simple Interest by Decimals, several methods of computing Interest on notes and obligations having indorsements are introduced. To mention all the rules is needless, as they stand for examination, and can be referred to; I will, therefore, only add that after having passed through the different rules, the whole is closed with questions for exercising the rules, to which is added some miscellaneous matter, I leave it to the candid and impartial examiner to decide upon the merit or demerit of the work; after observing that no pains has been spared to render the work easy and pleasing to the learner; using every exertion so to arrange it as to render him all the information his capacity may require, in order to comprehend the useful science of Arithmetic. To the teachers and scholars of this great American republic, this volume is presented, hoping, that it may prove an essential benefit to all; which is the ardent wish of

The public's most devoted
and humble servant,
THOMAS W. CONKLING.

New-York, 1831.

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An Explanation of some of the Marks and Characters made use of in Arithmetic.

Signs.	Names.	Significations.
$=$	equal to.	The sign of equality; as, 100cts = $ 1. that is, 100 cents are equal to 1 dollar.
$+$	plus or more.	The sign of addition; as $5+3=8$; that is, 5 more 3 is equal to 8.
$-$	minus or less.	The sign of subtraction; as, $6-4=2$; that is, 6 less 4 is equal to 2.
$\times$	multiplied by, or into.	The sign of multiplication; as, $8\times3=24$; that is, 8 multiplied by 3 is equal to 24.
$\div$ 4)8(2	divided by.	The sign of division; as, $8\div4=2$; that is, 8 divided by 4 is equal to 2.
$\frac{240}{25}$		Numbers placed like a fraction likewise denote division, the lower number being the divisor and the upper the dividend.
: : :	is to. so is.	The sign of proportionals; as 2 : 6 :: 8 : 24; that is, as 2 is to 6 so is 8 to 24.
$\surd$	extraction of the roots.	
$\surd$ or $^2\surd$		The sign that the square root of that number is required; thus, $^2\surd9=3$; that is, the square root of 9 is equal to 3.
$^3\surd$		The sign that the cube root of that number is required; thus, $^3\surd64=4$; that is, the cube root of 64 is equal to 4. &c.

ERRATA.

Page 15, 15th line from the bottom, for *four* read *one*.
34, 12th line from the top, for 262 rem. read 162 remainder.
44, To the table of Liquid Measure, add 4 hogsheads make 1 tun.
56, 7th line from the bottom, for *and* 2 *over* say *and* 2 *pounds over*.
78, under the 11th sum, for 350 read 250.
102, 8th line from the top, for *roods* read *rods*.
102, 7th sum, for 2p. in the Ans. read 20p.
140, 4th sum, for ⅓d. in the answer read ¼d.
146, 3d sum in case 4th, read for answer 5C. 3qrs. 10lbs.+
155, in example for illustration, read 1422 for 1442.
156, 2d sum, for the rem. read $\frac{23}{52}$ for $\frac{22}{32}$.
157, 2d sum, for the anwer read $ 336 for $ 366.
182, 8th sum, for O's stock, read 170 for 120.
189, in example for illustration, draw the line under the 4th quan-
instead of between the 3d and 4th.
traction of Vulgar Fractions read Subtraction of Deci-

2d answer for 8lbs at 4cts. read 2lbs. at 4cts.

ARITHMETIC.

Arithmetic is the art, science, or knowledge of computing numbers, (which consist of one or more quantities,) and has five principal or fundamental rules; viz. Notation or Numeration, Addition, Subtraction, Multiplication and Division; each of which will be treated of.

NUMERATION.

Numeration teacheth to read or express the true value of any number; consequently any proposed number can be written down according to its value, which is done by placing in due order, the following characters or figures.

one	two	three	four	five	six	seven	eight	nine	cipher
1	2	3	4	5	6	7	8	9	0

The last is called a cipher which, by itself, is nought; but when it stands to the right of one or more of the characters or figures mentioned, it increases the figure or figures in a tenfold proportion, as 10 stands for ten, 120 for one hundred and twenty. The value of the other characters or figures when standing alone, may be understood as follows: 1 is of itself but one, as one yard, one penny, &c. 2 is two ones, 3 three ones, &c. till you get to 9, which in value is nine ones, as 1 yard or 1 penny nine times told. Beside the simple value of figures here explained each has a value depending upon the place it stands in. One figure standing by itself expresses its own value as before explained, but when combined with one or more figures the value is increased according to the number and situation of the figures mentioned, and may be understood by strictly attending to the table constructed for this purpose, which you will find hereafter inserted. But to illustrate it plainly, observe that beginning at the right hand and reckoning to the left, the first figure represents its own value, that in the second place ten times its simple value, and so on, the value of each figure being ten times the value of the last mentioned. The first is called units, the second tens, the third hundreds, the fourth thousands, &c. as you will see in the table. For farther illustration, attend to what follows; let 3854 be the number under consideration; this in value is three thousand eight hundred and fifty-four may be thus understood, beginning at the right hand and reckoning (as has been observed,) to the left. The right hand figure is 4, which is no more in value than four times one; the next is 5, and increases the number in a tenfold proportion, that is 5 times 10 are 50 which, with the 4, makes 54; the next figure is 8, which is 10 times greater than the last and is increased by 100 times its simple value; this makes 800, and connected with the 54, makes 854; the last figure 3 is reckoned in the same proportion, and is 10 times greater than the last, or 1000 times its simple value, which is 3000; this, connected with the other figures, makes what was first mentioned, viz. 3854.

Another illustration; suppose 45369 be the number whose value is to be determined, you may understand it thus:

The first figure is simply	9	9
The second increased tenfold is	60	combined together 69
The third increased as before	300	369
The fourth in like manner	5000	5369
The fifth	40000	45369

This last example may be read thus, nine, sixty-nine, three hundred and sixty-nine, five thousand three hundred and sixty-nine, forty-five thousand three hundred and sixty-nine.

As soon as the following table is learned, there will be no great difficulty in comprehending the value of as many figures as will be necessary.

NUMERATION TABLE.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands	Thousands.	Hundreds.	Tens.	Units.	
								1	One
							2	1	Twenty-one
						3	2	1	Three hundred and twenty-one
					4	3	2	1	Four thousand 321
				5	4	3	2	1	54 thousand 321
			6	5	4	3	2	1	654 thousand 321
		7	6	5	4	3	2	1	7 million 654 thousand 321
	8	7	6	5	4	3	2	1	87 million 654 thousand 321
					4	3	2	1	987 million 654 thousand 321
					3	9	8	7	456 million 123 thousand 987
					2	1	7	8	569 million 432 thousand 178

You will perceive that the first place of figures, is units, the second tens, the third hundreds, &c. By this table nine places of figures can be enumerated; which for common use will be sufficient; but to enumerate a larger number, the following may be observed.

When a number of figures is given to be read, it will be found convenient to divide them into as many periods of six figures each as you can, reckoning from right to left; the first period being called units, the second millions, the third billions, &c. as in the following table.

Sextillions.	Quintillions.	Quadrillions.	Trillions.	Billions.	Millions.	Units.
7 Period.	6 Period.	5 Period.	4 Period.	3 Period.	2 Period.	1 Period.
946.258;	713.395;	173.826;	143.697;	495.213;	191.216;	493.121;
Thousand.	Thousand.	Thousand.	Thousand.	Thousand.	Thousand.	Thousand.

The foregoing figures may be read thus.

Nine hundred and forty-six thousand two hundred and fifty-eight sextillions; seven hundred and thirteen thousand three hundred and ninety-five quintillions; one hundred and seventy-three thousand eight hundred and twenty-six quadrillions; four hundred and forty-three thousand six hundred and ninety-seven trillions; four hundred and ninety-five thousand two hundred and thirteen billions; one hundred and ninety-one thousand two hundred and sixteen millions; four hundred and ninety-three thousand one hundred and twenty-one.

Note.—Billions are substituted for millions of millions. Trillions for millions of millions of millions. Quadrillions for millions of millions of millions of millions, &c. There are others that might be mentioned besides those in the last table, viz. Septillions, Octillions, Nonillions, Decillions, Undecillions, Duodecillions, &c. the value of which are determined in the same manner as those mentioned above.

APPLICATION.

RULE.

Remember to begin at the right hand; write un place of units, tens in the place of tens, hundreds in the place of hundreds, and so continue on to the left, writing each figure according to its proper value in numeration. Take care that you supply the places that would come in order, with ciphers, when they are omitted in the question.

EXAMPLES.

Write down in figures the following numbers.

Sixteen.

Two hundred and sixteen.

Five thousand two hundred and sixteen.

Sixty-four thousand two hundred and sixteen.

Nine hundred and eight thousand three hundred and fifty-seven.

One million.

Three millions two hundred and sixty-eight thousand seven hundred and forty-one.

Three hundred and thirty-three thousand and five.

Six hundred and forty millions one hundred and one thousand and four.

Twenty-two millions three hundred and nine thousand and ninety-seven.

Nine thousand nine hundred and ninety-nine.

Write down in words the following numbers.

5, 4345, 66, 927, 21492, 213145, 121, 425925, 100000000, 709, 3040, 9002, 50434, 160029, 3040864, 910703, 36002009.

ADDITION AND SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	5	6	7	8	9	10	11	12	13	14
3	5	6	7	8	9	10	11	12	13	14	15
4	6	7	8	9	10	11	12	13	14	15	16
5	7	8	9	10	11	12	13	14	15	16	17
6	8	9	10	11	12	13	14	15	16	17	18
7	9	10	11	12	13	14	15	16	17	18	19
8	10	11	12	13	14	15	16	17	18	19	20
9	11	12	13	14	15	16	17	18	19	20	21
10	12	13	14	15	16	17	18	19	20	21	22
11	13	14	15	16	17	18	19	20	21	22	23
2	14	15	16	17	18	19	20	21	22	23	24

SIMPLE ADDITION.

Simple Addition teacheth to add several numbers into one sum which is called the total or amount, and may be understood thus, suppose one man owes you 8 dollars, another 6, and another 4, these added or put together make 18 dollars; which is the sum total of what they owe you.

RULE.

Place units under units, tens under tens, hundreds under hundreds, &c. that is, suppose 5, 364, and 18, were to be added together, you must place them thus,

h	t	u
		5
3	6	4
	1	8

Write down your figures in the order they ought to stand in, then begin with the units or right hand column, adding together the figures in it; then consider how many tens are contained in their sum, place all over even tens under the column; carry as many to the next column as there were tens contained in the one just added, then proceed to add it up as you did the last; cast out the tens as before; set down all over even tens and carry as before directed to the next column; so proceed on till the whole is finished, minding to set down the whole amount of the last column under it.

This rule is very plain, and perhaps it will appear more so by attending to the following*

EXAMPLE FOR ILLUSTRATION.

	Thousands.	Hundreds.	Tens.	Units.
	4	8	9	6
	5	4	2	1
	7	8	3	8
	6	9	4	9
	2	9	6	4
2	8	0	6	8

To add this example I began with the first or right hand column, and said 4 and 9 are 13 and 8 are 21 and 1 are 22 and 6 are 28, this is the amount of the first column. What must be set down under this? 8. Why? Because there are 2 tens in 28 and 8 over; this I set directly under the column added, as you will see in the example; then I proceeded to the next, remembering to carry 2 for the tens in the last column, and said 2 that I carry to 6 are 8 and 4 are 12 and 3 are 15 and 2 are 17 and 9 are 26, now how many tens are there in 26? 2 tens and 6 over; so I set down 6 and carried 2 to the next, saying 2 to 9 are 11 and 9 are 20 and 8 are 28 and 4 are 32 and 8 are 40. How many tens does this column contain? 4 tens and 0 over; because 4 tens are 40, under this I set down 0 and carried 4 to the next column which is the last, saying 4 to 2 are 6 and 6 are 12 and 7 are 19 and 5 are 24 and 4 are 28. Here I observed what the rule said about the last column, and accordingly set down the whole number 28, and the sum was done, the total amount being twenty-eight thousand and sixty-eight.

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* *The learner may work out the* examples for illustration as it will *give him a better idea of* the rules.

PROOF.

Begin at the top of the columns, and reckon downward in the same manner as they were added upward; and if the work is right, the sum total will be the same.

There are some other methods of proving this rule; but I think this sufficient.

If the learner has been attentive, I think he will be able to do the following sums, which are added in the same manner as the one given for illustration.

EXAMPLES.

Units.
8
4
6
8
7

Tens.	Units.
8	9
5	4
3	3
7	2
6	1

Hundreds.	Tens.	Units.
4	2	8
9	1	6
4	8	1
2	1	5
3	4	3

Thousands.	Hundreds.	Tens.	Units.
6	1	2	5
4	9	3	8
2	1	6	3
8	9	5	4
5	8	2	5

X of Thous.	Thousands.	Hundreds.	Tens.	Units.
4	6	8	3	5
9	2	1	6	3
1	3	9	6	5
2	1	4	7	7
7	2	1	3	4

Yards.	Miles.	Leagues.
612548	4283568	59836219
295486	2459489	63874261
169348	9482059	67834216
920546	2041699	30005121
192483	5382169	15901279
278659	2145172	48932169

Days.	Months.	Years.
68953562	989548626	214353954
99248341	721695364	162348921
71647721	156793482	483167264
58721763	692744348	999621413
78216945	834126914	214172193
64283472	194269741	472173319

Inches.	Feet.
[illegible]	3872568
682196	354821
41376	38472
264	1693
9698	100
4216382	20
296	4627432
98784	2006904

16 Add into one sum the following numbers, 4964, 5691, 8928, 3642, and 4399.

Place the above numbers under each other, units under units, tens under tens, &c. and proceed as before.

17 Add 365, 6428, 92456, 2929, 986, together.

18 What is the sum total of 689434, 960, 794869, 425000, 325, 96, 5?

19 What is the amount of the following: nine hundred and ninety-one, [illegible]nty-nine, three thousand two hundred and seventy, forty-two thousand two hundred and four, two hundred and twenty-three millions three thousand and thirty-six?

20 Add nine, eight hundred and ninety-nine, fifty-two thousand nine hundred and twenty-two, nine millions eight hundred and forty-seven thousand eight hundred and five, ninety-seven thousand eight hundred and sixty-two, four hundred and ninety-four and nine together.

21 What is the sum of 66843, 9024, 804, 72, 8, 47, *6209, 67234?*

For more examples in Simple Addition, see questions to exercise.

SIMPLE SUBTRACTION.

SIMPLE SUBTRACTION teacheth to take a *less* number from a *greater* of the same name or denomination, and thereby shows the difference or remainder; the meaning of which may be understood thus:—Suppose you had 7 apples and I should take 4 of them, you would have 3 left; or suppose that from 6 yards you take 4, the remainder will be 2.

RULE.

Place the greater number first or uppermost, and the less one under it, observing the same directions that were given in Addition; viz. to keep units under units, tens under tens, &c. then draw a line under them. Begin first with the right hand figure or units place, and subtract it from the figure that stands directly over it; being careful to put the remainder which you get, under the figure you are subtracting, then proceed to the next figure on the left; do the same with that, and proceed on. Here observe, that if the lower figure is greater than the upper, you must add 10 to the upper figure, and then take the under figure from it; place the remainder down as before, and carry 1 to the next figure; for whenever you borrow 10 to make your upper figure more than your under figure, you must carry 1 to the next figure of the under line, which makes that one more; so proceed till the sum is done.

Or, instead of adding 10 to the upper figure, you may, when the under figure is largest, take it from 10 and add the remainder to the upper figure, and set it down; this will bring the same remainder as the first mentioned method.

PROOF.

To the under or lesser number of figures, add the remainder, and if it be like the greater or upper number the work is right.

EXAMPLE FOR ILLUSTRATION.

10 I first placed what I borrowed, viz. 10 over the sum,
Yards. and proceeded, saying 3 from 7 leaves 4, this I set down
86547 as you will see, then I went to the next figure saying 0
89603 from 4 four remains; I set down 4 and said 6 from 5 I
——— cannot take, then 5 and 10 are fifteen 6 from 15 leaves
46944 9 this I set down; here I had to carry 1. Why? because
——— d 10; so I said 1 to 9 the next figure makes
10 I cannot take; here I added the 6 to 10,
; then 10 from 16 leaves 6 set down 6 and

carry 1 to the next figure 3, which makes it 4; four from 8 four remains; this being the last figure, the sum was completed.

Or, according to the other method I proceeded, saying 3 from 7 leaves 4; then to the next and said 0 from 4 four remains; then 6 from 5 I cannot take, but 6 from 10, (the number I borrowed) leaves 4; this added to 5 the upper figure, makes it 9; here I carried 1; because I borrowed 10, and said 1 that I carry to 9 the next figure are 10; now 10 from 9 I cannot take, but 10 from 10 leaves 0; so I had nothing to add to 6 the upper figure; I therefore set down 6 and passed to the last figure, carrying 1 to it; saying 1 to 3 are 4, four from 8 four remains, and it was done; this brought the same remainder as before.

You must borrow 10 in each of the following examples:

EXAMPLES.

	£	Yards.	Leagues.
Greater or upper number	865	52874	684132
Lesser or under number	243	41695	193428
Remainder			

	Days.	Months.	Yards.	Miles.
From	4683706	24368364	28472134	687543212
Take	1693497	17379218	5831321	7546193

From	94000062030	26495273	289648252
Take	6385934943	12985372	119648325

From 24838963 take 13742866

From 76346216 take 538431

From 6384956 take 2949869

From 800008 take 94269

16 From one hundred thousand take ten.

17 From thirty-nine thousand three hundred and twenty-four, take twenty-two thousand nine hundred and sixty-nine.

18 From twenty-two millions, take twenty-two thousand.

19 What is the difference between twenty-two thousand and seventy-seven, and forty-two thousand and forty-two?

20 Subtract three hundred thirty-six, from three thousand nine hundred and forty-two.

21 From two thousand and two, take one thousand and nine.

22 From one million, subtract two hundred and two.

This is a very useful rule, and I hope you will pay attention to what follows:

Simple Multiplication teacheth how to repeat or increase any one number by another, so often as there are units in that number by which it is increased; or, it is the multiplying of any two numbers together; as 6 times 9 are 54. Multiplication, is a short way of performing several additions, It has been observed that 6 times 9 are 54; now if you set down 9 six times under each other, and add them together, their sum will be 54, which is the same as 6 times 9 multiplied; and so with regard to any greater or less number. This rule consists of three principal parts, viz.

1. The *multiplicand*, or number to be increased or multiplied; and this is the upper figure or line of figures.

2. The *multiplier*, or number that the multiplicand or upper line of figures is to be increased by; it being the number you multiply by, and is set under the multiplicand.

3. The *product*, or number produced by multiplying; and this is the result, or answer to the question.

The *multiplicand* and *multiplier* are called *factors*.

CASE I.

To multiply when the multiplier is not more than 12.

RULE.

Place the greatest number first or uppermost; set the multiplier underneath the right hand figure or figures of the multiplicand or upper number, keeping units under units, &c. Multiply the first or unit figure of the multiplicand by the multiplier; and if their product be less than ten, set the whole down under its own place of units; but if their product be more than ten, then see how many tens are contained in the number; set down all over even tens, and carry one for every ten, (as in addition,) bearing in mind what you carry, till you have multiplied the next figure of the multiplicand by the same figure of the multiplier, and to their product add what you carry, setting down all over even tens as before; and so proceed, till every figure of the multiplicand or upper line of figures is multiplied by the multiplier, minding to set down the last as in Addition.

PROOF.

There are several methods of proving multiplication. First, by division; but as the learner is supposed to be ignorant of that *Rule, he cannot* prove by it. Secondly, multiply the multiplier by *the multiplicand* and if it produces the same as before, it is considered *right*. Thirdly, cast out the 9's contained in the multiplicand and multiplier, noting down the remainders; multiply these two remainders together, and note down their excess over even 9's; cast out the 9's in the total product, and if the excess be equal to the excess of the two remainders mentioned, it is supposed to be right. There are some objections to the last method, as it will in certain instances prove a sum to be right when the work is wrong.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

The table ought to be well learned before you proceed to the following sums.

EXAMPLE FOR ILLUSTRATION.

	Months.	Proof.
Multiplicand	846591	6
Multiplier	6	6
Product	5079546	0

I began by saying 6 times 1 are 6, set down 6, then 6 times 9 are 54, set down 4 and carry 5, (the reason for carrying 5 is because there are 5 tens in 54,) I set down 4 as I observed, and said 6 times 5 are 30 and 5 that I carry are 35. Here are 3 tens and 5 over; set down 5 and carry 3; then 6 times 6 are 36 and 3 that I carry are 39; set down 9 and carry 3; 6 times 4 are 24 and 3 are 27; (pay attention,) set down 7 and carry 2 for the 2 tens in 27; and lastly 6 times 8 are 48 and 2 that I carry are 50; here I set down the whole number 50 according to rule, and the sum was done.

This produced the same answer that would have been brought, had I set down the multiplicand six times and added the whole together.

To prove this sum, by casting out the nines I began wi the multiplicand, and cast out the nines, and found that there were 6 over even 9's; this I placed opposite the multiplicand, (it is no matter how many nines there are only note down what is over the last or even 9's,) I then proceeded to the multiplier which being only 6 I placed it opposite the multiplier, I multiplied these two together, saying 6 times 6 are 36, nine into 36 four times and 0 over; the 0 I placed opposite the product, I now cast out the nines in the product, and found that to contain even nines, there being 0 over; this coming like the excess of the two remainders mentioned, the work was considered right.

EXAMPLES.

	£	Dollars.	Yards.
Multiply	95483	49538265	6958431
by	2	3	4
Product			

	Feet.	Inches.	Farthings.
Multiply	63377562	94653384	87269568
by	5	6	7
Product			

	Miles.	Leagues.	Days.
Multiply	91482176	46932984	91340021
by	8	9	10
Product			

	Barrels.	Gallons.	Pounds.
Multiply	84732169	74834621	93990207
by	11	12	12
Product			

CASE II.

When the multiplier consists of several figures, to find their *product.*

RULE.

s, as before directed, observing to set the figures of the multiplier exactly under those of the multiplicand, beginning at the left hand, and going to the right: after this is done begin with the right hand figure of the multiplicand, and proceed with it as before. Then multiply the next figure towards the left, minding to set the first figure directly under the figure you are multiplying by, and the rest in order as they come. In this manner proceed, till you have multiplied by every figure in the multiplier. Add these several products together, and their sum will be the desired, or whole product.

EXAMPLE FOR ILLUSTRATION.

Miles.	
7368548	Multiplicand.
627	Multiplier.
51579836	
14737096	
44211288	
4620079596	Product.

In this sum, you will perceive that in the first place, I multiplied by 7; the first figure of the multiplier; placing the product of that as in the last examples. I then proceeded to multiply by 2, the second figure of the multiplier; placing the first figure of this product exactly under the figure that I was multiplying by, which comes under the second figure of the last product; and the rest in order as they come, I then multiplied by 6, the last figure of the multiplier, placing the first figure in a line directly under the figure that I multiplied by, which comes one figure farther to the left than the first figure of the last product; after multiplying this out I added the several products together; this sum was the total product or answer to the question.

By carefully examining the rule and this example, you may be able to find the answers to the following questions.

EXAMPLES.

Seconds.	Minutes.	Hours.	Days.
39542	672543	349984	764384
38	95	248	1945
1502596	63891585	86796032	1486726880

Weeks.	Months.	Years.	Dollars.
694321	462843	598743	892143
3298	16554	29915	38845
2289870658	7661903022	17911396845	3465529

CASE III.

When ciphers are intermixed with, or come in between the figures that have signification in the multiplier, to find the product.

RULE.

Omit, or pass by, the cipher or ciphers that come in said multiplier, and multiply by the next significant figure; taking care to place the first figure of the product exactly under the figure you are multiplying by, (as before taught,) and so proceed till you have done multiplying; add these products together as before, and their product will be the sum required.

EXAMPLE FOR ILLUSTRATION.

	Rods.
Multiply	65483
by	2004
	261932
	130966
Product	131227932

After multiplying by 4, I omitted the ciphers and multiplied by 2, the next significant figure, placing the first figure of that product directly under the 2, and the other figures in order as they come, then I added these products together, which produced the answer.

EXAMPLES.

Quarts.	Pecks.	Bushels.
358684	954836	296548
64005	80063	30706
22957569420	76447034668	9105802888

CASE IV.

When there are ciphers on the right hand of either the multiplicand, or multiplier, or both.

RULE.

Place the significant figures under each other, and proceed to multiply as before; neglecting the ciphers, till you have multiplied by each significant figure; add the products together as before, minding to place to the right of the total product, as many ciphers as there are to the right of both the multiplicand and multiplier. Or, you may first place the ciphers to th- [illegible] of the significant figures, and proceed to multiply as

EXAMPLES FOR ILLUSTRATION.

Gallons.
269400
340

10776
8082

91596000

The example on the left is done according to the first mentioned method; I omitted the ciphers, till I had multiplied by the two significant figures; after adding these products together, I placed, to the right of this last or total product, the ciphers omitted, which produced the answer to the question.

Gallons.
269400
340

10776000
8082

91596000

The example on the right hand is done according to the last mentioned method; by first placing, to the right of the significant figures, as many ciphers as there were in both the multiplicand and multiplier; then proceeding to multiply, and add up as before, which produced the same result.

EXAMPLES.

Pounds.	Ounces.	Drachms.
4908300	249690	4893600
61500	3096000	19340
301860450000	773040240000	94642224000

NOTE.—When 1 and 1, or 1 and 2, come together in the multiplier you may multiply by both figures at once, in the following manner.

Yards.
Multiply 387654
by 123

1162962
4651848

47681442

After multiplying by 3, I multiplied by 1 and 2 both at once, saying 12 times 4 are 48; &c. placing the first figure under the 2; after I had done multiplying, I added it as before. *Observe.* This product is the same that would have been brought had I multiplied by 3, 2, and 1, separately.

EXAMPLES.

Chaldrons.	Bushels.	Pecks.
654387	875462	654387
612	117	511
400484844	102429054	334391757

CASE V.

When the multiplier is such a number, that any two figures in the table being multiplied together will produce said multiplier:

RULE.

Multiply the given number by one of the figures that produce the multiplier; and then, that product by the other. If the work be right, the result will be the product required.

EXAMPLE FOR ILLUSTRATION.

	Ounces.
Multiply	368546
by	56

You will perceive by the table that 7 times 8 are 56; the given number must be multiplied, first, by 7; and, then, that product by 8.

Ounces.
368546
7
2579822
8
20638576

The process of this question is as here illustrated. It is done by multiplying, first, by 7, and, then, that product by 8, as before stated. This method brings the same answer that would have been brought, had the given number been multiplied by 56, as before taught.

EXAMPLES.

Farthings.	Pence.	Shillings.	Pounds.
695984	874835	567389	775643
56	35	63	72
38975104	30619225	35745507	55846296

The first of these examples is done in the same manner as the one given for illustration.

For the next, find what two figures in the table will make 35, (see 5 times 7,) multiply, first, by one of these figures, and, then, that product by the other. Thus proceed with the other examples; finding, in the first place, what figures in the table will produce the multiplier.

TO MULTIPLY

R- 1000, &c. set down the multiplicand; and, under-
multiplier; minding to put the significant figure
-hand, or units place, of the multiplicand.

Multiply by this significant figure, and join the ciphers to the right hand of this product. The operation is performed

	Guineas.	
thus	5863	
	100	This being so plain any farther illustration is deemed unnecessary.
	586300	

EXAMPLES.

Cents.	Miles.
78437	65943
100	1000

Note.—You can multiply by 20, 300, 400, &c. in the same manner as here directed.

Eagles.	Dollars.	Dimes.
62849	58726	65438
200	20	400

SIMPLE DIVISION.

Simple Division teacheth to find how often one number is contained in another:

Or, it teaches how to divide any number, or quantity given, into any number of parts assigned.

It is a short way of performing several subtractions, and consists of the following parts, viz.

1 The *Dividend*, or number to be divided:

2 The *Divisor*, or the number which is given to divide by:

3 The *Quotient*, or answer to the question, and this answer shows how often the divisor is contained in the dividend:

4 The *Remainder*, which is always less than the divisor, and is of the same name with the *Dividend*.

When the divisor is not more than 12:

RULE.

Seek how often the divisor is contained in the first

the left hand of the dividend; or if the first figure be less than the divisor, then, in the first figures of the dividend, when you have found how many times the divisor is contained in the figure or figures as before mentioned, set the number in the quotient; if any remains, carry this to the next figure in the dividend, minding to call this remainder so many tens; that is if 1 remains, call it 10; if 2 call it 20, if 3 call it 30, &c. Remember to add this to the next figure, and then seek how often the divisor is contained in this number; proceed to the next, and so on, till you have made use of all the figures in the dividend.

This is called SHORT DIVISION.

PROOF.

Multiply the quotient by the divisor; and as you multiply, add in the remainder, (if any;) and if it comes like the dividend, the work is right; there are several other methods to prove Short Division, but this I think sufficient.

EXAMPLE FOR ILLUSTRATION.

Dividend.
Divisor 6) 5849329
Quotient 974888—1
6
Proof 5849329

Here 6 being the divisor, I began with it, saying, 6 into 58; now 9 times 6 are 54 and 4 over; I set down the 9 and carried the 4, saying (according to rule,) 4 tens are 40, the next figure, being 4, makes 44; again, I said 6 into 44, seven times 6 are 42 and 2 over. What now? Here are 2 over; these are 2 tens, which make 20, and the next figure 9 makes 29; now I said, 6 into 29 four times and 5 over; again, 5 times 10 are 50 and 3 are 53; six into 53, eight times and 5 over; again, 5 times 10 are 50, the next figure 2 makes 52; six into 52, eight times and 4 over; here again, 4 tens are forty and the last figure 9 are 49; six into 49, eight times and 1 over; which I set down a little way off; this completes the division of the sum, for I have made use of all the figures in the dividend. You will see how it is proved. I multiplied the quotient by the divisor adding in the remainder, this product coming like the dividend showed the work to be right.

EXAMPLES.

Miles.	Leagues.	Yards.	Inches.
2)1684326	3)2864834	4)4181214	5)7820035

Chaldron.	Bushels.	Pecks.	Quarts.
6)7437583	7)5689543	8)4968288	9)8568432

10)4832567 11)4832195 12)8578575

To divide by 10, 20, 30, 40, &c. till you get to 120.

Note.—Cut off the cipher in the divisor, and cut off one figure to the right of the dividend; then divide as before taught. Remember, that if there be a remainder, it is so many tens to be added to the figure cut off.

EXAMPLE FOR ILLUSTRATION.

Divisor 2|0)38547|6

19273-16 Rem.

Quotient.

In this example, I divided as before; and, when I came to the last figure 7, I said, 2 into 7 three times, and 1 over; which I called one 10, and 6 the figure cut off makes 16; so that 16 is the remainder; and, when the question is proved, the 16 must be added in.

Moidores.	Guineas.	Crowns.	Dollars.
20)5986432	40)6874727	70)5943221	120)8947862

When the divisor consists of many figures, you divide by what is called

LONG DIVISION.

To divide by Long Division, you must pay particular attention to the following.

RULE.

It is supposed that you know what Divisor, Dividend, Quotient, and Remainder mean; and, to understand the operation of Long Division, observe first; see whether the divisor be less than as many figures on the left hand of the dividend; if so, then judge how often the divisor is contained in those figures; this may be *done by considering* how often the first figure of the divisor is *contained in the first* figure of the dividend; after you find place it in the quotient, and multiply the divisor by it, and place the product exactly under the figures of the dividend that you sought how often your divisor was contained in; then, draw a line underneath it, and subtract it from said figures; (here you must observe this last product; for, it must not be greater than the part of the dividend made use of; likewise, your remainder must not be greater than your divisor. If either be as here stated, the work cannot be right, you must observe this through the operation;) now, bring down the next figure in the dividend to the right of the remainder; after which, you must seek how often the divisor is contained in this number; place the number thus found in the quotient; then multiply and subtract as before; after this, bring down the next figure; so proceed on till all the figures of the dividend are brought down. *Note*, when it happens that the divisor is more than so many figures of the dividend, you must take one more figure in the dividend than you have in the divisor, and proceed as before, seeking how often the first figure of the divisor is contained in the two first figures of the dividend, making allowance for what you carry from the right hand. Also, you must mind that if in any case, the remainder be so small, that when the figure of the dividend is joined, or brought down to it, that it is still a less sum than the divisor; then a cipher is to be placed in the quotient and another figure brought down; if it be still less than the divisor, place another cipher in the quotient, and bring down another figure; so continue to do, till the number is as great, or greater, than the divisor, and then proceed as before.

Proof. Observe the same as given under Short Division.

EXAMPLE FOR ILLUSTRATION.

```
          Dividend. Quotient.
Divisor  24)1634195 (68091
            144          24
            ———      ——————
             194     272364
             192    136182
             ———
              219        11 Rem.
              216   ———————
              ———   1634195 Proof.
                35  ———————
                24
                ——
                11 Remainder.
                ——
```

To find the quotient, or answer to this question, I began by saying how often is 24 contained in 16, the first two figures of the dividend. I perceived that the divisor 24 was more than 16; consequently not contained in it; I then said, (according to rule,) how often is 24 contained in 163, the first three figures? Here I judged how often the first figure of the divisor 2 was contained in 16, the first two figures of the dividend, which I found (after allowance was made for what I carried,) to be 6 times; this I placed in the quotient, and then multiplied the divisor by it; saying 6 times 4 are 24, set down 4 and carry 2; then 6 times 2 are 12; and 2 that I carry are 14; this, you will see comes under the 163, the three left hand figures of the dividend. Here I noted whether the under figures (that is the 144,) were greater than the figures immediately over them; that is the 163, which were not; I then proceeded to subtract the 144 from the 163; saying, 4 from 3 I cannot take, 4 from 13, nine; set down 9, and carry 1 to 4 are 5, then 5 from 6, one; then 1 from 1, nothing; here I had 19 remainder, which being less than the divisor, I proceeded to bring down the next figure of the dividend which was 4, and annexed it to the last remainder 19; this made 194; again, I said, how often is 24 contained in 194? I found by the same operation as before that it was 8 times; I placed this in the quotient to the right of the last figure, and proceeded to multiply the divisor by it; saying, 8 times 4 are 32, set down 2 and carry 3; then, 8 times 2 are 16 and 3 are 19; having set this down, I had 192 to subtract from 194, which I did by saying, 2 from 4, two; 9 from 9, nothing; 1 from 1, nothing; I now brought down the next figure of the dividend, and annexed it to 2, the last remainder and went on, saying, how often is 24, the divisor, contained in 21? I found that it was not contained in it; so I set a cipher in the quotient, and brought down the next figure of the dividend, annexing it to the last brought down, and proceeded to ascertain how many times 24 were contained in 219; which I found to be 9 times; this I placed in the quotient, saying 9 times 4 are 36; set down 6 and carry 3, nine times 2 are 18 and 3 are 21; here, I had 216 to subtract from 219; I went on, saying, 6 from 9, three; then, 1 from 1, nothing; 2 from 2, nothing; here, I had 3 remainder; I now brought down the last figure of the dividend, and annexed it to this remainder as before, and sought how often 24 was contained in 35, which being once, I set this in the quotient, and said once 4 is 4; once 2 is 2; I subtracted this, saying 4 from 5, one; two from 3, one; here, I had 11 for my last remainder; as all the figures of the dividend had been brought down, the sum was done.

I proceeded to prove it by multiplying the quotient by the divisor, taking care to add the last remainder to the product. I found that this product exactly corresponded with the dividend, *so I concluded that* the work was right.

EXAMPLES.

Divisor. Dividend. Quotient.
365)8754322(23984
730
———
1454
1095
———
3593
3285
———
3082
2920
———
1622
1460
———
262 Remainder.

Divisor. Dividend. Quotient.
498)2678467(5378
2490
———
1884
1494
———
3906
3486
———
4207
3984
———
223 Remainder.

It will be best for the learner to work the last three examples at length; by so doing, and strictly examining the rule, he may find the quotient or answer to the following questions.

4 Divide 1798467 by 24, Answer 74936 and 3 Remainder.

Divisor. Dividend. Quotient.
To be placed thus, 24)1798467(74936 & 3 Remainder.

5	Divide	4986384	by	95	*Ans.* 52488 and	24 Rem.
6		3248695	by	421	7716	259
7		9238643	by	854	10818	71
8		1207028	by	1048	1151	780
9		83865448	by	3246	25836	1792
10		224836762	by	26957	8340	15382
11		1749265	by	49384	35	20825
12		869432	by	28		
13		695834	by	146		
14		486954382	by	278698		

CASE II.

When the divisor has a cipher or ciphers on the right hand.

RULE.

Cut off the cipher or ciphers in the divisor, and cut off as many figures on the right hand of the dividend; divide as before by those figures of the divisor that are left when the ciphers are cut of[illegible]hen the division is ended, the figures that were cut off in the dividend must be placed to the right of the remainder, (if any,) and the figures cut off in the divisor restored to their own places again, as in the

EXAMPLE FOR ILLUSTRATION.

```
62|000)127854|786(2062
       124
       ---
        385
        372
        ---
         134
         124
         ---
          10786
          -----
          62000
          -----
```

Here, according to rule, I cut off the ciphers in the divisor; and, then, cut off as many figures on the right of the dividend; you will see that I divided by 62; after I had brought down all the figures in the dividend (rejecting those cut off,) I placed those cut off to the right of the last remainder, under which I placed the divisor, remembering to restore the ciphers cut off. This operation brings the same answer and remainder that would have been brought had I divided without cutting off, but this method makes the work shorter.

EXAMPLES.

2	Divide	264287	by	620	*Ans.*	426	and	167	Rem.
3		169482	by	30600		5		16482	
4		84821496	by	1000		84821		496	
5		333640092	by	216000		1544		136092	
6		90009420	by	20060		4487		200	
7		2824927	by	300				127	
8		10048269	by	480000				44826	

CASE III.

When the divisor is such a number that any two figures in the multiplication table being multiplied together will produce said divisor.

RULE.

Divide the given dividend by one of those figures, and that quotient by the other, the last division will give the quotient required.

NOTE—The total remainder (or the remainder that would have been brought by dividing by the whole number at once,) is found by multiplying the last remainder by the first divisor, and adding in the first remainder.

EXAMPLE FOR ILLUSTRATION.

Divide 69483 by 48.

```
6)69483
 -------
8)11580-3
 -------
  1447-4
 -------
```

To find the quotient or answer to this, I sought what two numbers being multiplied together would make, or produce 48; by the table I found that 6 times 8 produced 48; so, according to rule, I divided first by 6, and then by 8; here you will see, that when I divided by 6 I had 3 remainder, and when by 8, I had 4; and, to find the total remainder I proceeded according to note under the rule; thus I multiplied 4, the last remainder, by 6 the first divisor; this produced 24, which I added to 3 the first remainder; this brought 27 the total remainder.

EXAMPLES.

2 Divide 897456 by 56 *Ans.* 16026 and 0 Total Remainder.

You will find by the table that 7 times 8 are 56.

3	Divide 548369	by 35	*Ans.*	15667	and 24	Total Rem.
4	816643	by 63		12962	37	
5	284632	by 72		3953	16	

See that you endeavour to understand every Rule; read it over with care, and try to get the meaning of it; by so doing you will get along with less difficulty.

* * *

COMPOUND ADDITION.

Compound Addition teacheth how to add several sums or numbers together, having different names or denominations; as pounds, shillings, and pence; dollars and cents; tons, hundreds, quarters; &c.

RULE.

1 Place the numbers so that those of the same name or denomination may stand directly under each other; that is, place pounds under pounds; shillings under shillings; pence under pence; farthings under farthings, &c.

2 Begin to add at the lowest name or denomination; that is, begin at the right hand column, as in whole numbers, and after you have added it, divide the amount of the column by as many of the same name as makes one of the next greater, setting
mainder under the column added and carry the
he next greater or superior denomination; then
unt of that, and divide it by as many of the same

name as make one of the next greater, setting the remainder down as before; and so proceed to the last, which add as in Simple Addition.

PROOF.

See the Rule for proving Simple Addition.

ENGLISH AND FEDERAL MONEY.

ENGLISH MONEY.

4 farthings	make	1 penny,	*d*
12 pence	"	1 shilling	*s*
20 shillings	"	1 pound	£

NOTE.—£ stands for pounds; *s* for shillings; *d* for pence; and *qrs* for quarters or farthings, which may be thus understood; £, Libra, meaning pounds; *s*, Solidi, shillings; *d* Denarii, pence; *qrs*, Quadrantes, farthings. Observe, farthings are written thus:

1 *qr* or ¼ for one farthing.
2 *qrs* or ½ for two farthings or half penny.
3 *qrs* or ¾ for three farthings.

PENCE TABLES.

d.	s.	d.	d.	s.	d.	s.	d.	s.	d.
20=	1	8	80=	6	8	1=	12	7 =	84
30	2	6	90	7	6	2	24	8	96
40	3	4	100	8	4	3	36	9	108
50	4	2	110	9	2	4	48	10	120
60	5	0	120	10	0	5	60	11	132
70	5	10	130	10	10	6	72	12	144

FEDERAL MONEY.

This is the most simple and easy of all money increasing, like whole numbers, in a tenfold proportion.

The denominations of Federal money, or money of the United States are, eagle, dollar, dime, cent, and mill.

10 mills	make	1 cent, mills are marked (m)	cents	c.
10 cents	"	1 dime	dimes	d.
10 dimes	"	1 dollar	dollars	$.
10 dollars	"	1 eagle	eagles	e.

A table shewing the number of cents in a shilling, from 1 shilling to a $.

cents.	s.	cents.	s.	cents.	s.	cents.	s.
12½ are	1	25	2	37½	3	50	4
62½	5	75	6	87½	7	100	8

4

As it is common in business to divide the money of the United States into two, or, at most, three parts, the following work will be divided, into dollars, cents, and mills. Dollars and cents are the most common division.

For the rule to add Federal money, the learner is desired to refer to the rule under Simple Addition.

In dollars and cents, or Federal money, it is best to use a point, or separatrix, as it is called, to separate the dollars from the cents. This may be understood thus, in 2348 cents, place a point two figures from the right, towards the left, that is, cut off two figures for cents; the other figures to the left will be dollars. In the before mentioned number, place a point as directed, and it will stand thus, 23.48, which are 23 dollars 48 cents; or suppose you wish to point off 46892 mills; here point off one figure to the right for mills, then two more towards the left for cents; the figures to the left of the last point will be dollars. The above number will be pointed off thus, 46.89.2, and may be read as follows; 46 dollars, 89 cents, 2 mills.

Note.—Any sum of money may be read differently. It may be read in the lowest denomination, or partly in the higher and partly in the lower. For example, 6345 cents, may be read 63 dollars 45 cents, or 6 eagles, 3 dollars, 4 dimes, 5 cents.

EXAMPLES FOR ILLUSTRATION.

10	20	12	4
£.	s.	d.	qr.
24	14	6	1
43	17	9	3
17	14	10	1
18	16	11	2
39	10	7	2
144	14	9	1

$.	c.	m.
48	32	6
158	91	3
141	63	5
93	91	6
29	38	7
472	17	7

In the first place, I set the number* that I must divide by over each column. Over the quarters, or farthings, I placed 4, because 4 farthings make a penny; over the pence, 12, because 12 pence make a shilling; over the shillings, 20, because 20 shillings make a pound; over the pounds, 10, because the last colu[illegible]ned as whole numbers. I now commenced adding

---

r conveniency, and to assist the memory, you may place
n or denomination, the number you are to divide by.

the [illegible]
I are [illegible]
saying. [illegible]
pence [illegible]
are [illegible]
the [illegible]
this I [illegible]
9 pence [illegible]
[illegible]
I [illegible]

[illegible]

D	c
1698	93
3692	28
9326	49
4952	27
43	16

£	s	d	qr
216	9	4	2
196	4	10	1
362	1	1	2
948	4	2	1
16	9	3	3

D	c
3695	49
2146	28
6589	34
7932	16
214	28

£	s	d	qr
169	17	4	3
719	16	7	2
20	10	10	1
17	11	6	3
28	19	11	1
17	0	10	3

D	c	m
2036	41	8
1420	01	1
101	90	2
21	17	0
107	21	3
91	63	8

£	s	d	qr
291	3	8	2
103	10	10	3
510	19	11	1
501	14	6	2
61	1	4	1
107	16	9	3

D	c	m
3834	28	2
2194	16	8
7348	21	3
4868	17	2
8248	10	0
4832	16	8

£	s	d	qr
16518	16	3	1
23419	17	2	1
61917	19	3	3
21413	17	6	2
1934	16	10	3
3169	17	5	1

D	c
914	43
761	49
999	99
191	90
199	69
986	21

TROY WEIGHT.

The denominations of Troy Weight, are, pound, ounce, pennyweight, and grain.

24 Grains make 1 Pennyweight.
20 Pennyweights 1 Ounce.
12 Ounces 1 Pound.

Observe, gr. stands for grains, pwt. for pennyweights, oz. for ounces, lb. for pounds. By this weight, gold, silver, electuaries, and liquors are weighed.

lb	oz	pwt	gr
24	8	17	21
16	11	19	17
8	9	7	6
9	6	12	20
			12
			7

lb	oz	pwt	gr
19	10	14	12
18	6	16	23
5	8	4	3
8	8	10	17
1	9	6	10
8	3	17	5

lb	oz	pwt	gr
21	11	3	20
14	10	16	19
12	8	14	7
6	3	5	9
8	3	10	14
6	0	15	15

Pay attention to the table, so that you may know what to divide by. The right hand column is grains, [illegible] place 24, because 24 grains make 1 pennyweight, [illegible] the pennyweights, because 20 pennyweights make 1 [illegible] and 12 over the ounces, because 12 ounces make 1 [illegible] The last or left hand column is same as whole numbers, [illegible] you must place [illegible] over it.

AVOIRDUPOIS WEIGHT.

The denominations of Avoirdupois Weight are [illegible] weight, quarter, pound, ounce, and dram.

16 drams	make	1 ounce	[illegible]
16 ounces		1 pound	[illegible]
28 pounds		1 quarter	[illegible]
4 quarters or 112 lbs.		1 hundred weight	[illegible]
20 hundred weight		1 ton	[illegible]

[illegible] hundred weight [illegible]

This weight is used in weighing [illegible] drossy nature, as groceries, [illegible] except gold and silver.

Note.—A [illegible] 200 lbs. A [illegible]

EXAMPLES.

lb	oz	dr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	11	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	15	9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	8	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	9	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	7	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Be careful and not make mistakes [illegible] you divide by, over the same.

APOTHECARIES' WEIGHT.

The denominations of Apothecaries' Weight are pound, ounce, drachm, scruple, and grain.

20 grains	make	1 scruple	[illegible]
3 scruples		1 drachm	[illegible]
8 drachms		1 ounce	[illegible]
12 ounces		1 pound	[illegible] weight in

medicines, but buy and sell by avoirdupois weight.

EXAMPLES.

℔	℥	ʒ	℈	gr	℔	℥	ʒ	℈	gr
14	11	6	1	14	21	8	5	2	17
16	10	6	0	18	17	10	7	0	12
18	8	5	2	12	12	6	6	1	11
21	6	4	1	10	10	5	6	2	10
14	7	3	1	9	23	7	7	1	8
8	9	7	0	6	31	9	3	2	6

Set 20 over the grains; for the rest, I shall leave you to examine the table.

CLOTH MEASURE.

The denominations of Cloth Measure are, yard, quarter, nail, and inch.

2¼ inches	make	1 nail
4 nails		1 quarter of a yd.
4 quarters		1 yard
3 quarters		1 Ell Flemish
5 quarters		1 Ell English
6 quarters		1 Ell French

in. stands for inches; na. for nails; qrs. for quarters; yds. for yards; E Fl. for Ells Flemish; E E. for Ells English; E Fr. for Ells French. The yard is used in measuring all sorts of woollen cloths; wrought silks; most linens, &c. The Ell English, is used in measuring some particular linens, calico, and Holland. The Ell Flemish is used in measuring tapestry.

EXAMPLES.

Yds	qrs	na	E E	qrs	na	E F	qr	na
21	3	2	17	4	3	17	1	3
19	2	3	21	3	3	16	2	1
23	2	1	16	2	1	21	2	3
17	0	3	21	3	2	17	1	0
40	1	1	41	0	2	28	1	3
27	3	2	29	2	0	46	0	1

set the number of nails in a quarter, and the
rs in a yard.

LONG MEASURE.

The denominations of Long Measure are, degree, league, mile, furlong, rod, or pole, yard, foot, inch, and barley corn.

3 barley corns	make	1 inch
12 inches		1 foot
3 feet		1 yard
5½ yards		1 rod or pole
40 poles		1 furlong
8 furlongs or 1760 yards		1 mile
3 miles		1 league
60 geographic miles		1 degree
69½ statute miles		1 degree
360 degrees		the circumference of the earth.

NOTE.—A fathom is 6 feet, and is used only to measure the depth of water. A hand is 4 inches, and is used to measure the height of horses.

b. c. stands for barley corns, in. for inches, ft. for feet, yds. for yards, p. for poles, fur. for furlongs, m. for miles, le. for leagues, deg. for degrees.

By this measure, the distance of places, or any thing else that hath length only, is measured.

EXAMPLES.

Yds	ft	in	b c	Le	m	ft	p	Yds	ft	in
59	1	8	1	58	1	7	18	61	2	11
38	1	11	1	91	2	5	14	93	1	8
61	2	7	1	69	1	7	15	68	1	10
93	0	10	0	71	0	6	17	53	2	6
88	1	6	2	93	1	4	14	16	1	9
15	2	4	1	77	1	3	15	61	0	8

Place over the first sum the barley corns in an inch, the inches in a foot, the feet in a yard, &c.

LAND, OR SQUARE MEASURE.

The denominations of Land Measure are, square acre, rood, rod, pole or perch, yard, foot, and inch.

144 square inches	make	1 square foot
9 square feet		1 square yard
30¼ square yards		1 square rod
40 square rods or poles		1 square rood
4 square roods		1 square acre

P stands for poles; R for roods; A for acres. This measure bespeaks its own use.

EXAMPLES.

A	R	P	A	R	P	A	R	P
149	3	24	621	1	27	216	3	32
219	3	16	211	3	18	196	1	19
369	1	21	201	1	20	291	3	8
569	3	10	142	2	20	121	2	6
941	2	17	214	1	18	101	0	3
121	1	14	160	0	4	220	3	6

You will find by the table, that 40 poles make 1 rood, and 4 roods make 1 acre.

LIQUID MEASURE.

The denominations of Liquid Measure are, tun, pipe, hogshead, barrel, gallon, quart, pint, and gill.

4 gills	make	1 pint
2 pints		1 quart
4 quarts		1 gallon
31½ gallons		1 barrel of wine
32 gallons		1 barrel of ale
36 gallons		1 barrel of beer
42 gallons		1 tierce
63 gallons		1 hogshead of wine
54 gallons		1 hogshead of beer
2 hogsheads, or 126 gallons		1 pipe or butt

gi. stands for gills; pts. for pints; qts. for quarts; gal. for gallons; bls. for barrels; tier. for tierces; hhds. hogsheads; p. for pipes; T. for tuns.

NOTE.—A gallon of wine contains 231 solid inches; and a gallon of beer 282.

All brandies, spirits, cider, vinegar, molasses, oil, &c. are *measured by* this measure.

EXAMPLES.

Hhds	gal	qts	pts
31	49	2	1
65	21	3	0
81	16	2	1
45	10	1	0
73	21	3	1
66	17	0	0

Hhds	gal	qts	pts
61	38	[illegible]	[illegible]
79	26	2	[illegible]
91	16	3	0
37	20	2	1
60	33	1	1
15	17	1	0

T	hhds	gal	qts
17	3	29	3
31	2	21	3
28	3	17	2
61	2	20	1
92	1	13	0
67	0	10	1

For the first sum you may place 2 over the pints, 4 over the quarts, and 63 over the gallons. In the second, place 54 over the gallons for beer measure; examine the table for the rest. In the third, put 63 over the gallons for wine.

DRY MEASURE.

The denominations of Dry Measure are, chaldron, bushel, peck, gallon, quart, and pint.

2 pints	make	1 quart
8 quarts		1 peck
4 pecks		1 bushel
8 bushels		1 quarter of corn
36 bushels		1 chaldron of coal

pts. stands for pints; qts for quarts; pks. for pecks; bush for bushels; qrs. for quarters; ch. for chaldrons.

The standard bushel is 18½ inches diameter, and 8 inches deep; by dry measure, grain, salt, coal, beans, flaxseed, oysters, &c. are measured.

EXAMPLES.

Bu	pks	qts	pts
39	3	6	1
67	1	7	1
91	3	3	0
87	2	7	1
28	0	1	1
17	1	5	1

ch	bu	pks	qts	pts
49	21	2	4	0
95	22	3	5	1
66	17	1	7	1
46	16	3	2	0
61	20	2	6	1
39	10	1	3	1

qrs	bu	pks
26	7	3
77	6	2
91	5	3
49	6	2
21	1	0
71	5	2

For the first sum, see how many pts make a qt; qts make a pk; and pks *make a bush.*

SOLID MEASURE.

The denominations o[illegible]lid, or Cubic Measure are, cubic cord, ton, foot, and inc[illegible]

1728	inches	make 1 solid foot
40	feet of round or 50 feet of hewn timber	1 ton or load
128	solid feet, or 8 feet long, 4 feet broad, and 4 feet high	1 cord of wood

S f. stands for solid feet; T for tons; C for cords. By this measure are measured such things, as have length breadth and depth.

EXAMPLES.

T	ft.	in
199	27	132
98	31	163
74	37	87
85	13	93

Cords	feet
46	112
89	122
93	101
77	116

You will find, by the table, that 1728 solid inches make one foot, and 40 feet one ton; likewise 128 feet make one cord.

TIME.

The denominations of Time are, year, month, week, day, hour, minute, and second.

60	seconds	make 1 minute
60	minutes	1 hour
24	hours	1 day
7	days	1 week
4	weeks	1 month
13	months 1 day 6 hours, or 365 days 6 hours	1 common or Julian year.

sec. stands for seconds; min. for minutes; h. for hours; d. for days; w. for weeks; mo. for months.

Note.—365 days, 5 hours, 48 minutes, 57 seconds and a fraction* make a solar year ; but 365 days 6 hours, being reckoned a common or Julian year, the odd 6 hours makes every 4th year one day more. This day is added to February, which gives it 29 days, and this is called bissextile or leap year; but agreeable to the most exact observation the [illegible] mentioned above.

* 39 thirds.

The year is also divided into 12 calendar months, which, in number of days, are unequal, as follows:

Month.	Names.	Days	Month.	Names.	Days.
First	January	hath 31	Seventh	July	hath 31
Second	February	28	Eighth	August	31
Third	March	31	Ninth	September	30
Fourth	April	30	Tenth	October	31
Fifth	May	31	Eleventh	November	30
Sixth	June	30	Twelfth	December	31

The number of days in each month may thus be found:

Full thirty days hath September,
With April, June, and November;
The other months have thirty-one,
Save February, which alone
Claims twenty-eight, but in fine
A leap year gives it twenty-nine.

EXAMPLES.

mo	w	d	h	m	sec
14	3	5	16	43	48
18	2	6	10	41	37
51	1	4	21	43	51
91	3	1	18	35	31
79	3	4	10	18	50

yrs	mo	w	d	h	m	sec
17	5	1	5	17	37	55
71	9	3	6	10	19	39
55	8	1	3	7	18	16
31	9	3	1	9	40	31
70	7	3	5	19	59	37

Over the mo in the second sum, you may place 12, the number of months in a year; for the other denominations, examine the table.

MOTION.

The denominations of Motion, or Circular Motion, are sign, minute, and second.

60 seconds make 1 prime minute.	″ stands for	seconds.
60 minutes 1 degree.	′	minutes.
30 degrees 1 sign.	°	degrees.
12 signs, or 360 degrees make the whole circle of the Zodiac.	S	signs.

EXAMPLES.

S	°	′	″
6	15	14	18
9	19	38	49
4	16	41	40
8	28	39	53
3	*19*	*50*	*50*

S	°	′	″
28	17	48	56
17	27	41	38
38	15	39	53
69	17	10	19
16	8	57	4

The next rule is Compound Subtraction. See that you read the Rule with care; likewise attend to the Example for Illustration, that you may understand the operation.

COMPOUND SUBTRACTION.

COMPOUND SUBTRAC[illegible] teacheth to find the difference between any two sums of different denominations; as money, weights, measures, &c.

RULE.

Place those numbers under each other which are of the same name or denomination; remember, that the greater number must be placed uppermost, and the less number directly under it; then, begin at the right hand, or least denomination, and take the difference between the under figure and the one immediately above it; place the difference of these two under the column subtracted, and go to the next; and so proceed till the sum is done. Observe, that if the under figure be greater than the upper, you must then borrow as many of that denomination as make one of the next greater; subtract your under number from this, and add the remainder or difference to the upper figure, remembering to carry one to the next column; and so proceed on till the work is finished.

NOTE.—You may place the numbers over each denomination, as taught in Compound Addition; for then it can be seen at once what to borrow, when the under figure is greater than the upper.

EXAMPLE FOR ILLUSTRATION.

10	20	12	4
£	s	d	qrs.
68	7	9	2
29	16	7	3
38	11	1	3

After having placed the numbers over each denomination, as directed, I began with the right hand figure; saying, 3 farthings from 2 I cannot take, but 3 from 4, the number I borrow, leaves 1; this I added to the upper figure 2, which made it 3; this I set down, and passed to the next, taking care to carry one, which must always be done when I have to borrow; then I said, 1 that I carry to 7 are 8; then 8 from 9 leaves 1; here I did not have to carry any; because I did not borrow. Now, to the next: 16 from 7 I cannot take, but 16 from 20 leaves 4, which added to the 7 makes 11; this I set down, and proceeded, hat I carry to 9, makes 10; now 10 from 8 I cannot rom 10 leaves 0; I have nothing to add to the 8, consequently I must set down 8 and carry 1 to 2, which makes 3; here I said, 3 from 6 leaves 3; this being the last figure, the sum was done.

For proof, see the rule for proving Simple Subtraction.

OF MONEY.

Observe: The Subtraction of Federal money is performed the same as Simple Subtraction.

EXAMPLES.

10	20	12	4			
£	s	d	qrs	$	c	m
486	15	4	2	3684	41	3
195	17	8	3	1695	73	9
290	17	7	3	1988	67	4
486	15	4	2	3684	41	3

These sums are proved by adding the under or less number of figures and remainder together. Their sum being like the greater or upper number, the work is considered right.

Examine the last three examples with care, so that you may understand Compound Subtraction.

£	s	d	qrs	$	c	m	£	s	d	qr	$	c	m
463	14	7	2	68	84	3	927	13	3	1	641	17	3
134	8	5	1	27	85	5	29	19	3	2	193	19	8

When you do not know what to borrow, refer to the tables; remember that in dollars, cents, and mills, or in Federal Money, you borrow 10.

£	s	d	qrs	$	c	£	s	d	qrs	$	c	m
639	0	3	2	549	63	176	7	0	1	246	83	0
107	10	5	3	193	90	49	14	7	2	28	37	2

	£	s	d	qrs		$	c	m
Suppose you borrow	86	19	7	1	Suppose you lend	1365	49	3
And pay back	49	16	3	3	And receive back	839	59	5
There remains unpaid					There is still due			

TROY WEIGHT.

lbs	oz	pwt	gr
48	1	16	21
29	11	16	22

lbs	oz	pwt	gr
69	9	19	18
18	10	19	20

lbs	oz	pwt	gr
87	10	13	20
64	11	15	23

AVOIRDUPOIS WEIGHT.

lbs	oz	dr.
48	14	12
19	13	15

[illegible]	qrs	lbs
61	1	22
29	2	23

T	C	qrs	lbs	oz	dr
17	16	2	12	11	10
18	16	3	27	14	15

APOTHECARIES WEIGHT.

℔	℥	ʒ	℈	gr
21	10	5	1	17
17	11	6	0	18

℔	℥	ʒ	℈	gr
28	4	6	0	12
19	11	1	0	12

CLOTH MEASURE.

Yds	qrs	na
19	2	1
7	1	2

E E	qrs	na
21	3	1
10	3	2

E F	qrs	na
16	0	1
4	0	3

Yds	qrs	na
19	1	1
5	2	2

In Cloth measure, you will see that 5 quarters, make an Ell English; and 6 quarters, an Ell French; for the second sum, you may place 4 over the na. and 5 over the qrs. and over the na. in the third sum, place 4; and over the qrs. 6.

LONG MEASURE.

Yds	ft	in	b c
71	1	10	1
17	2	10	2

Le	m	fur	po
61	1	5	29
12	2	4	39

Yds	ft	in
16	2	1
4	2	2

LAND MEASURE.

A	R	P
27	1	20
		21

A	R	P
91	0	23
14	0	24

A	R	P
87	3	10
19	2	12

Yds	sq ft
16	5
10	8

You will see by the table, that 9 square feet make a yard.

LIQUID MEASURE.

Hhds	gal	qts	pts
38	28	3	0
6	44	3	1

hhds	gal	qts	pts
91	60	2	1
12	60	3	1

T	H	gal	qts
19	3	29	3
9	3	40	1

DRY MEASURE.

Bu	pks	qts	pts
101	2	5	0
10	3	5	1

Ch	bu	pks	qts	pts
17	21	1	6	1
16	25	3	7	1

qrs	bu	pks
81	3	2
19	2	3

SOLID MEASURE.

T	ft	in
227	41	129
197	45	126

Cords	feet
182	61
96	110

If you are at a loss, what to place over each denomination, turn back to addition of solid measure, and read the observations made there.

TIME.

Mo	w	d	hrs	min	sec
17	3	5	21	40	41
10	3	6	22	40	48

Yrs	mo	w	d	hrs	min	sec
19	10	3	2	17	41	18
9	9	3	3	21	20	20

MOTION.

S	°	′	″
7	21	49	21
4	20	49	25

S	°	′	″
8	28	28	30
6	29	40	50

Read the observations at the close of compound additio
I *wish you to attend* to them, while commencing the foll
ule.

COMPOUND MULTIPLICATION.

Compound Multiplication teacheth to multiply, (by one common multiplier,) when the sum or number consists of several names, or denominations.

CASE I.

To multiply by any number not exceeding 12.

RULE.

Set the multiplier, under the last figure, on the right hand, (or lowest denomination mentioned,) of the multiplicand; multiply the figure immediately above by it, and divide the product by as many of that denomination, as make one of the next greater; setting the remainder under the figure multiplied, and carry the quotient to the next; multiply the next, and then add what you carry to it, divide as before; so proceed till the work is done. You may observe the same rule for carrying from one denomination to another, as given in compound addition.

To multiply Federal money, observe the same rule as given in multiplication of whole numbers, minding to put the point of separation, (or separatrix, as it is called,) between the denominations, just as many figures from the right hand towards the left, in the product, as in the multiplicand, or given sum, as you will see in the following example of Federal money.

EXAMPLES FOR ILLUSTRATION.

10	20	12	4
£	s	d	qrs
48	7	4	3
			6
290	4	4	2

Having, (as in Compound Addition, and Subtraction,) placed the numbers over each particular denomination, I began by saying, 6 times 3 are 18: this, I divided by 4, (the farthings in a penny,) and found that it contained 4 times 4, and 2 over; the 2, I set down under the quarters, and went on; saying, 6 times 4 are 24, and 4 that I carry, are 28; now, how many times 12 in 28? Twice, and 4 over; set down 4, and carry 2; then, 6 times 7 are 42, and 2 that I carry, are 44: how many times 20 in 44? Twice, and 4 over; set down 4, and carry 2; again, 6 times 8 are 48, and 2 that I carry, are 50; here, I divided by 10, consequently, set down 0, and carried 5; saying, 6 times 4 and 5 are 29; I set down the whole number and the

ae.

EXAMPLE IN FEDERAL MONEY.

D	c	m
86	49	3
		9
778	43	7

This example, is multiplied the same as in whole numbers; and the only difficulty that arises is, to know where the points ought to stand; but by observing, what was said under Compound Addition, I think the difficulty will be removed, but if the learner should still be at a loss where to place the point, he must observe, that if the multiplicand be dollars, cents, and mills, as in the above example; point off one figure, from right to left for mills; then point off two figures from that point for cents, the rest towards the left, (if any,) will be dollars; but when dollars and cents only are mentioned, point off two figures for cents from the right towards the left; the rest will be dollars.

EXAMPLES.

£	s	d	qrs
48	9	10	3
			2

D	c	m
692	39	3
		3

£	s	d	qrs
168	19	3	2
			4

D	c	m
864	91	9
		5

lbs	oz	pwt	gr
64	10	17	21
			6

T	C	qrs	lbs	oz	dr
16	14	1	20	10	9
					7

℔	℥	ʒ	℈	qr
67	10	5	2	18
				8

Yds	qr	na
91	3	3
		9

Le	m	fur	po
65	2	7	32
			10

A	R	P
64	3	30
		11

T	hhds	gal	qts
13	2	42	3
			12

Ch	bu	pks	qts
39	21	3	5
			13

Cords	ft
129	69
	10

Y	mo	w	d	h	m	sec
10	9	3	5	20	41	41
						6

S	°	′	″
28	14	50	40
			12

CASE II.

To multiply by any given number more than 12, the multiplier being the exact product of any two numbers in the multiplication table.

RULE.

Multiply the given sum by one of those numbers that produce the multiplier, and that product by the other; the last product will be the answer.

EXAMPLE FOR ILLUSTRATION.

	£	s	d	qrs	
Multiply	62	10	4	3	by 24
				3	
	187	11	2	1	
				8	
	1500	9	6	0	

Here I mutiplied by 3, and then by 8; because 3 times 8 are 24. I began, saying 3 times 3 are 9; then, 4 into 9 twice, and 1 over, and so on. After multiplying this out, I multiplied by 8, saying 8 times 1 are 8, four into 8 twice and 0 over; set down 0 and carry 2. Thus I continued till I had multiplied each figure.

EXAMPLES.

	C	qrs	lbs		C	qr	lbs
2. Multiply	12	2	8 by 64	Ans.	804	2	8

	£	s	d	qr		£	s	d	qr
3. Multiply	36	14	7	1 by 72	Ans.	2644	11	6	0

	A	R	P		A	R	P
4. Multiply	28	3	10 by 36	Ans.	1037	1	0

5. Multiply 4T. 2hhds. 16gal. 2qts. by 81.
Ans. 369T. 3hhds. 13gal. 2qts.

6. Multiply 2Le. 2m. 7fur. 20po. by 132.
Ans. 393Le. 0m. 6fur. 0po.

If at any time you do not know how to proceed, refer to the rules and examples for illustration.

CASE III.

When the given number cannot be produced by the multiplication of any two numbers in the table:

RULE.

First, find what two figures in the table multiplied together will come nearest to the given number: multiply by them as before, and then, multiply the upper line by what remains; add the result to the last product, and their amount will be the answer.

EXAMPLE FOR ILLUSTRATION.

	C	qrs	lb	
Multiply	2	1	6	by 59
			8	
	18	1	20	product of 8
			7	
	129	0	0	product of 56
	6	3	18	product of 3
	135	3	18	product of 59

By the table, I found that 8 times 7 are 56; this being nearest to the given multiplier, I multiplied, first, by the 8, and then that product by 7; this last is the product of 56. As the given number was 59, I had 3 remainder, which I multiplied the upper line, or given number, by; saying 3 times 6 are 18, &c. I placed the product under the last, then added them together; their sum was the total product of multiplying by 59.

EXAMPLES.

2. Multiply 24£. 16s. 8d. 1qr. by 38. Ans. 943£. 14s. 1d. 2qr.

6 times 6 are 36; consequently there will be 2 to multiply the upper line by.

3. Multiply 122£. 17s. 9½d. by 76. Ans. 9339£. 12s. 2d.

9 times 8 are 72. How many more will make 76? multiply the upper line by it.

4. Multiply 9yds. 3ft. 5in. by 123. Ans. 1246yds. 3ft. 3in.

12 times 10 are 120. Then multiply the given number by —

5. Multiply 2lb. 10oz. 8pwts. 12gr. by 149.
Ans. 427lbs. 5oz. 6pwts. 12gr.

— times 12 are 144. Then — times the given sum.

* * *

COMPOUND DIVISION.

Compound Division teacheth to divide any number of different denominations by one common divisor.

CASE I.

To divide by any number not exceeding 12.

RULE.

Place the divisor and dividend as before taught; then, seek how often the divisor is contained in the left hand place of figures, setting the result under said figure, or figures, divided; and proceed to the next. But if there be a remainder, multiply it by the next lower denomination, (it being so many times the next denomination,) and, to this product add the number, (if any,) given of that denomination; seek how often the divisor is contained in this number; note down the result, and proceed with the remainder, (if any,) as before; and so on, till the whole is finished.

Observe. If the number of either denomination be less than the divisor, multiply it by the next lower denomination; add in the number, (if any,) and proceed on as before directed.

Note.—For Federal money, divide as in whole numbers, minding to place the point as before taught; that is, if dollars cents and mills be given, point off one figure from right to left of the quotient for mills; then, two for cents; the rest, (if any,) will be dollars. If there be dollars only, annex two ciphers, and the whole will be cents; or, annex three ciphers, and the whole will be mills.

Observe: That if you write down the sum in cents; the quotient, or answer, will be cents. If you write them in mills, the quotient will be mills. Remember, that if, in the given sum, the cents be less than 10, you should place a cipher to the left, or in the tens place, in this manner; for one dollar and six cents, write $ 1.06 cts.

PROOF.

Multiply the quotient by the divisor; and, if the product be equal to the dividend, the work is considered right.

EXAMPLES FOR ILLUSTRATION.

1. Divide 86£. 14s 7d. 2qrs. by 6. Ans. 14£. 9s. 1d. 1qr.

10	20	12	4
£	s	d	qrs
6)86	14	7	2
14	9	1	1
			6
86	14	7	2

In this example, as before, I placed the numbers over each denomination, (which the learner may do in the following examples;) then began, saying 6 into 8 once and 2 over; this 1 I set down under the 8, and proceeded with the 2, as in Simple Division; saying 2 tens are 20, and 6 are 26. Six into 26, four times and 2 over, now I said, twice 20 are 40, and 14, the shillings standing at this denomination, makes 54. Six into 54, nine times and 0 over. The 9 I set down; and as there was no remainder, I said, 6 into 7 once and 1 over; set down 1: then, once 4 is 4, and 2 are 6: then, 6 into 6 once and 0 over. This finished the sum. For proof, I multiplied by the divisor 6, as in Compound Multiplication.

2. Divide 48 dollars 7 cents 3 mills by 6.

Ans. $ 8.01cts. 2m. and 1 rem.

$	c	m	
6)48	. 07	. 3	
8	. 01	. 2	and 1 over
		6	
48	. 07	. 3	

After dividing, as in Simple Division, I pointed off the quotient, beginning at the right hand, pointing off one figure for mills; and, then, two for cents, which brought 8 dollars 1 cent and 2 mills for answer.

Endeavour to understand each rule, it will save you much trouble.

EXAMPLES.

£ s d qrs
2)43 5 7 2

$ c m
3)68 . 22 . 3

£ s d qrs
4)61 17 4 2

Dolls cts
5)9348.10

lbs oz pwts gr
6)17 10 21 10

T C qr lbs oz dr
7)16 7 1 21 8 14

C qrs lbs
8)16 3 7

Yds qr na
9)162 3 2

M fur p
10)161 3 20

A R P
11)112 3 3

T hhds gal qts
12)19 3 28 2

Ch bu pks qts
9)91 8 3 2

w d h m sec
10)41 6 3 5 20

£ s d qrs
11)649 14 7 2

° ′ ″
12)40 39 20

CASE II.

When the divisor exceeds 12, and is the exact product of any two figures in the multiplication table:

RULE.

Divide *the given sum* by one of those numbers, and that *quotient by the other; the* last quotient will be the answer.

EXAMPLE FOR ILLUSTRATION.

1. Divide $ 38.43 cts by 28 Ans. $ 1.37 cts 2 m and 2 rem.

```
 Dolls cts
 7|38 . 43
  |------
 4| 5 . 49 . 0
  |----------
  | 1 . 37 . 2 and 2 rem.
  | $    c   m
  |----------
```

In the table I found, that 7 times 4 are 28, which I placed as in the margin. The last quotient was 1 dollar 37 cents and 2 mills. When I divided by 4, there was 1 remainder; and as the given sum contained no mills, I added a cipher, and divided on; this brought 2 mills, and 2 remainder.

EXAMPLES.

2. Divide 49£. 6s. 8d. 2qrs. by 32.
Ans. 1£. 10s. 10d. 2qrs. and 2 rem.

3. Divide 7674 dollars 03cts. by 63. Ans. $ 121.81 cts.

4. Divide 122C. 3qrs. 18lbs. by 72.
Ans. 1C. 2qrs. 23lbs. and 14 rem.

5. Divide 32A. 3R. 10P. by 81.
Ans. 0A. 1R. 24P. and 66 rem.

6. Divide 364yds. 2qrs. 0na. by 108.
Ans. 3yds. 1qr. 2na.

7. Divide 583m. 5fur. 20po. by 132.
Ans. 4m. 3fur. 15po.

CASE III.

When the divisor is large, and cannot be produced by the multiplication of any two numbers in the table:

RULE.

Divide the highest denomination after the manner of Long Division; multiply the remainder, (if any,) by as many of the next lower denomination as make one of that, adding in the number standing there; then divide as before, and so on.

EXAMPLE FOR ILLUSTRATION.

1. Divide 178 £ 11 s 9 d by 39 Ans. 4 £ 11 s 7d.

```
     £    s   d    £   s   d
39) 178   11  9 (  4   11  7
    156
    ———
     22
      20
    ————
    451
    39
    ————
     61
     39
    ————
     22
     12
    ————
     273
     273
    ————
```

Here, I placed the sum as before, and went on, saying, how often is 39 contained in 178 the pounds in the question? I judged it to be 4 times; this I placed in the quotient, and multiplied the divisor by it, and got 156; this I set under the 178, and subtracted it; here I had 22 pounds remainder; this I multiplied by 20, the shillings in a pound, minding to add in the 11 shillings that was in the dividend; this brought 451 shillings. I now sought how often 39 was contained in 45, the first two figures; and found that it was once; this I placed in the quotient, and multiplied the divisor by it; and after multiplying, subtracting, and bringing down the other figure, I had 61 to seek how often 39 the divisor was contained in; which was once; this 1 I placed in the quotient with the last figure, multiplying and subtracting as before; here, I had 22 shillings remainder; this I multiplied by 12, the pence in a shilling, adding in the 9 pence in the dividend, which brought 273. I sought how often 39 was contained in this, which was 7 times; and, by multiplying the divisor by this, I got 273, and had 0 remainder; the result was 4 £ 11 s 7d in the quotient, which was the answer.

EXAMPLES.

2. Divide 821£. 11s. 9d. by 69.
Ans. 11£. 18s. 1d. 2qr. and 54 rem.

3. Divide 149£. 19s. 7d. by 103.
Ans. 1£. 9s. 1d. 1qr. and 89 rem.

4. Divide 268£. 11s. 4d. 2qrs. by 86.
Ans. 3£. 2s. 5d. 1qr. and 84 rem.

5. Divide 977A. 1R. 13P. by 623. Ans. 1A. 2R. 11P.

6. Divide 1381 dollars 68 cents. by 342.
Ans. 4 dolls. 04 cts.

Place the dollars and cents thus; 1381.68 and divide by 342, as in whole numbers.

☛ The following may be considered as belonging to Simple Multiplication, &c. but it will apply to both the Simple and Compound rules.

To multiply by a mixed number, that is, a whole number joined to a fraction, as 3¼, 7½, 5¾, 7⅛, &c.

RULE.

Multiply by the whole number, and take ¼, ½, ¾, ⅛, &c. of the multiplicand, (or upper number,) and add it to the product.

EXAMPLES FOR ILLUSTRATION.

1. Multiply 185 by 3¼ Ans. 601¼.

```
¼|¼|185
   |  3¼
   |-----
   |555
   | 46¼
   |-----
   |601¼
```

☛ I multiplied by the whole number 3; and then said, ¼ is the ¼, that is, one quarter or fourth is the one fourth of the given number, I divided the multiplicand by the 4, and then added the quotient to the product.

2. Multiply 266 by 4½ Ans. 1197.

```
½|½| 266
   |  4½
   |------
   |1064
   | 133
   |------
   |1197
```

After multiplying by the whole number, as directed, I said ½ is the ½, that is, one half is the half of the given number; and proceeded as before.

3. Multiply 368 by 5¾ Ans. 2116.

```
½|½| 368
   |  5¾
   |------
   |1840
¼|½| 184
   |  92
```

For the ¾, I first said, ½ is the ½, as in the last example; then ¼ is the ½ of that. You will see, that for the ½, I took half of the given number; and for the ¼ I took ½ of that quotient, and added the whole together. The 184 is ½ of the given number, and ¼; these together make ¾ of 368.

4. Multiply 9£. 9s. 5d. by $6\frac{1}{8}$. Ans. 58£. 0s. $2\frac{1}{8}$d.

		£	s	d
$\frac{1}{8}$	$\frac{1}{8}$	9	9	5
				$6\frac{1}{8}$
		56	16	6
		1	3	$8\frac{1}{8}$
		58	0	$2\frac{1}{8}$

By examining this example, you will see, that I multiplied by 6, Compound Multiplication; saying, 6 times 5 are 30, twelve into 30, twice, and 6 over; set down 6, and carry 2, &c. then I said, $\frac{1}{8}$ is the $\frac{1}{8}$; after dividing by 8, I added the quotient to the product.

◆

Questions for Exercise, in each of the foregoing Rules.

NUMERATION.

Express the following numbers in figures.

1. Three thousand seven hundred and twenty.
2. Sixty-seven millions nine thousand three hundred and forty.
3. Three hundred and sixty millions two hundred and forty-three thousand seven hundred and ten.
4. Ninety-nine millions and ninety-nine.
5. Seventy thousand seven hundred and seven.
6. Write down in words at length the following numbers, 6005005, 400004, 60009, 3030, 369, 48, and 267427.

SIMPLE ADDITION.

If you have been attentive to the rules passed through, there will be but little difficulty with the following questions. If you are at a loss, examine the rules, &c.

1. Add into one sum the following numbers, 26384, 92561, 32840, 2063, 149, and 42.

Place the numbers under each other; units under units, tens under tens.

2. What is the sum of the following numbers; viz. 225643821, 7692, 125, 44827, 6637, 492678, and 22?

3. Add 390, 3090, 70208, 590026, 8654321, and 681965 together; and see if their sum is ten millions.

4. What is the sum of the following numbers; viz. four thou

sand six hundred and forty-seven; twenty-nine thousand eight hundred and forty-one; three millions two hundred and sixty-one thousand seven hundred; eight hundred and fifty-six; and seventy-seven thousand three hundred and seven?

Place the numbers as they ought to stand. 4647 is the first number.

5. The sum of the following is a million; six hundred and thirty-six; three thousand six hundred and thirty-six; ninety-four thousand nine hundred and forty-five; eight hundred thousand and four; ninety-six thousand eight hundred and ninety-six; two thousand eight hundred and ninety-six; nine hundred and eighty-seven. Try and see.

COMPOUND ADDITION.

1. Suppose a man owes the following sums of money; 48£. 16s. 4d. 1qr. 61£. 12s. 8d. 3qrs. 18£. 15s. 7d. 3qrs. 21£. 16s. 5d. 3qrs. 81£. 16s. 0d. 2 qrs. how much does he owe in all?

Place the first numbers thus; 48. 16. 4. 1. with the proper denomination over each. Set the other numbers under these, keeping pounds under pounds, shillings under shillings, pence under pence, and farthings under farthings. You may place what you divide by over each denomination, and proceed as before taught.

2. If a man has due him the following sums; viz. 694 dollars 75 cents, 893D. 48cts. 260D. 20cts. 14D 82cts. $16.21cts. $148.91cts. and 10D.01ct. how much is due him in all?

Place the first number thus; 694.75 with $. over the dollars, and cts. over the cents; place the other numbers under this, and add as in Simple Addition.

3. Suppose you purchase the following quantities of wool. Sack No. 1. 3C. 2qrs. 14lbs. Sack No. 2. 5C. 1qr. 10lbs. Sack No. 3. 1C. 3qrs. 27lbs. Sack No. 4. 3C. 3qrs. 26lbs. what is the weight of the whole?

Place the first thus—Sack No. 1, 3. 2. 14. with C. qrs. lbs. over the columns to which they belong, place the others under these and proceed.

4. If a Farmer owns the following tracts of land, viz. Tract No. 1. 48A. 3R. 4P. Tract No. 2. 69A. 1R. 14P. Tract No. 3. 81A. 1R. 10P. Tract No. 4. 101A. 3R. 39P. Tract No. 5. 296A. 3R. 32P. how many acres &c. of land does he own.

If you do not know what to divide by, when you add, refer to the table.

purchase of a Collier the following quantities of
h. 13bu. 2pks. 8Ch. 17bu. 1pk. 9Ch. 28bu. 3pks.
3pks. 9Ch. 1bu. 1pk. how many chaldrons, bush-
ks have you purchased?

SIMPLE SUBTRACTION.

1. Suppose a man owed you $8762, and he pays you $2795, how much is still due you?

Put the greater number down first, and the less one under it; then proceed as taught in Simple Subtraction.

2. If it be 3000 miles across the Atlantic Ocean, and a vessel has sailed 1742 miles on her passage directly across how many miles has she to go?

3. If the salary of the President of the United States be twenty-five thousand dollars, how much will he have left after he has expended nine thousand nine hundred and sixty-five dollars?

4 Suppose an army of 36742 men should go into battle, and in the engagement there should be 6984 killed, how many would remain of the army?

5. If a man was born in the year of our Lord 1792, how old is he now if living?

For the upper number place the year in which you are working this question, set the given number under it, and proceed to subtract.

COMPOUND SUBTRACTION.

1. Suppose you have borrowed from your friend, 29£. 16s 7d. and have paid back 20£. 17s. 8d. how much do you owe him?

Place the greater number first, and the less under it; then proceed to subtract. The table will direct you what to borrow.

2. Suppose you had lent your friend $68.27cts. and he pays you in part $62.49cts. how much does he owe you?

This is performed the same as Simple Subtraction.

3. If you barter with a person, and give him goods to the value of 42D. 33cts. and you receive of him in return, goods to the amount of 39D. 94cts. how much is due you?

4. If you buy a hogshead of sugar, weighing 12C. 2qrs. 17 lbs. and the hogshead weighs 3qrs. 20lbs. how much sugar have you?

Set each denomination in its proper place.

5. Suppose you have a lot of ground containing 6A. 1R. 10P. and you sell a part of it, containing 2A. 2R. 20P. how much have you *left*?

This question contains Acres, Roods, and Perches. If you do [illegible] *what tc borrow, turn to* Land Measure table.

6. If, out of 36bu. 1pk. 5qts. of wheat, you sell 12bu. 3pks. 6qts. how much will you have left?

You borrow the quarts in a peck, and the pecks in a bushel.

SIMPLE MULTIPLICATION.

1. If you purchase at auction 119 pieces of India muslin each piece containing 11 yards, how many yards have you in the whole?

Set down 119, the number of pieces, and place 11 the number of yards in a piece, under it, and multiply as taught in Simple Multiplication.

2. Suppose you buy 162 firkins of butter, each containing 62lbs. how many pounds have you bought?

Multiply the number of firkins by the number of pounds in a firkin.

3. In 120 puncheons of rum, each containing 105 gallons, how many gallons in the whole?

4. How many pounds are there in 296 barrels of flour, each barrel containing 196lbs?

5. In 595 barrels of pork, each containing 200 pounds how many lbs?

COMPOUND MULTIPLICATION.

1. What will 9 yards of broad-cloth come to, at 1£. 2s. 6d. per yard?

Write down the one pound two shillings and sixpence, and place the nine under the pence; place what you divide by, over each denomination, and proceed, saying 9 times 6 are 54; then what you divide by into 54, &c.

2. If you buy 7 acres of land for 8£. 10s. 6d. per acre, how much does it come to?

Remember the tables; by them you may know what to divide by.

3. What will 12 yards of broad-cloth come to, at 2D. 50cts. per yard?

This is performed the same as Simple Multiplication; mind and point off two figures from right towards the left, for cents.

4. What will 6 pieces of muslin come to, at $ 3.49cts. per piece?

5. How much is contained in 12 hogsheads of sugar, each 6C. 3qrs. 21lbs?

6C. 3qrs. 21lbs. by the 12 hogsheads.

yards are there in 10 pieces of cloth, each 21

7. How many gallons of gin are there in 6 pipes, each containing exactly 102gals. 3qts. 1pt?

8. How many acres are there in 9 lots of ground, each containing 12A. 3R. 21P?

9. Multiply 16yrs. 5mo. 2d. 4hrs. by 25.

Instead of multiplying by 25, you may multiply as directed in Multiplication page 28.

SIMPLE DIVISION.

1. Divide 6282, by 9.

These questions are performed as taught in Simple Division.

2. In 4380 yards of muslin how many pieces, each 12 yards?

3. 2256 bushels of flax seed-how many casks containing 7 bushels each?

4. How many barrels of flour will 27620 bushels of wheat make, allowing 5 bushels to the barrel?

5. What is the quotient of 38694, divided by nine?

COMPOUND DIVISION.

1. If you buy 6 yards of cloth for $20.70cts. what did it cost per yard?

Performed the same as Simple Division, 6 being the divisor; point off as before directed.

2. Suppose 8 acres of land are sold for 362£. 16s. 8d. what is that per acre?

See the first example for illustration, Compound Division.

3. If $2365.80cts be divided between 12 men what will they have a piece?

4. Suppose 127C. 3qrs. 16lbs. of iron be divided among 11 men, how much will each have for his share?

Examine the rule, &c. of Compound Division.

5. If 10 gallons of rum cost 4£. 5s. 10d. what is it per gallon?

Performed like the second example.

PROMISCUOUS QUESTIONS.

For exercise in each of the foregoing Rules.

Try to find the answers to the following questions. If you find any difficulty, turn to the rules again, and examine the operations there.

1. What will 67 yards of broad-cloth come to, at 2D. 50cts. per yard? Ans. 167D. 50cts.

NOTE.—Though these questions appear to belong to higher rules than the learner has attained; yet they may be performed in this simple and easy manner; and I think he will be pleased to solve them, as they can be done by the rules that he has passed through, and with which he ought to be acquainted by this time.

The question above, is nothing more than Simple Multiplication; and I will only caution the learner to take care and place the point of separation where it ought to stand, between the dollars and cents.

2. What will 29lbs. of tea come to, at 31 cents per lb? Ans. $8.99 cts.

Performed by Multiplication.

3. If you buy wine at 16s. 8d. per gallon, what will 8 gallons come to at that rate? Ans. 6£. 13s. 4d.

Performed by Compound Multiplication, 8 being the multiplier.

4. A man is born in the year 1787, how old is he in the year 1831? Ans. 44 years

Simple Subtraction.

5. What will 9 yards of broad-cloth come to, at 1£. 2s. 6d. per yard? Ans. 10£. 2s. 6d.

Compound Multiplication.

6. If you buy flax for 18 cents per lb. how much will 128lbs. come to? Ans. $23.04 cts.

Simple Multiplication.

7. If rye be sold for 75 cents per bushel, what will 250 bushels come to? Ans. 187D. 50cts.

Performed like the last.

8. Suppose you wished to settle with your neighbour; and when you had brought your accounts together, you found his account against you was 48£. 17s. 3d. and you had ainst him, 29£. 19s. 10d. how much do you still owe Ans. 18£. 17s. 5d.

Subtraction.

9. What will 36 bushels of wheat come to, at 2½ dollars per bushel. Ans. 90 dollars.

Done like the second example for illustration, page 60.

10. What will 294lbs. of pork come to, at 12½cts. per lb? Ans. 36D. 75cts.

Performed like the last.

11. What will 48 yards of muslin come to at 37½cts per yard? Ans. 18 dollars.

12. What will 44 cords of wood come to, at 3¼ dollars per cord? Ans. 143 dollars.

Done like the first illustration, page 60.

13. What will 24 loads of wood come to, at 2¾ dollars per load? Ans. 66 dollars.

See the third illustration, page 60.

14. What will 28 days work come to, at 75cts. per day? Ans. 21 dollars.

Simple Multiplication.

15. If, from an army consisting of 26375, there be 10948 discharged, how many will be left? Ans. 15427

Simple Subtraction.

16. What is the weight of 9 hogsheads of sugar, each 8C. 3qrs. 24lbs? Ans. 80C. 2qrs. 20lb.

Examine Compound Multiplication.

17. If you buy 300 sheep at $1.75cts. per head, how much do they come to? Ans. 525 dollars.

Like Simple Multiplication.

18. If you trade with a merchant to the amount of $2.75cts. and you give him 10 dolls. how much change must you receive? Ans. 7D. 25cts.

19. Again, if you purchase goods to the amount of 6£. 7s. 4d. and you give 20 dollars, or 8£. to take the pay from, how much change must you receive? Ans. 1£. 12s. 8d.

Compound Subtraction.

20. If you buy 340 yards of muslin at 31¼cts. per yard, how much will it come to? Ans. 106 dolls. 25cts.

For the ¼, see the first example for illustration, page 60.

21. If you purchase 280 plank, at 18¾ cents a piece, and 520 boards, at 12½ cents a piece, how much does the whole come to? Ans. 117 dolls. 50cts.

For the ¾, see the third example, page 60. For the ½, the second. After *you have found what* each comes to, add the two products together, *their sum will be the answer.*

22. If you buy 10 yards of superfine cloth, how much will it come to, at 3£. 4s. 6d. per yard? Ans. 32£. 5s. 0d.

Compound Multiplication, 12 pence make a shilling, and 20 shillings a pound.

23. What will 22 head of cattle come to, at 31½ dollars a head? Ans. $693.

For the ½, proceed as before. See second example, page 60.

24. General Washington was born in the year 1732, how many years is it since, this being the year 1831? Ans. 99 years.

25. Columbus discovered America in the year 1492, how many years have passed since, this being the year 1831?

Ans. 339 years.

26. Suppose a man should give 5750 dollars to be divided between his 5 sons, how much would they have a piece?

Ans. 1150 dollars.

Done like Simple Division.

27. If a man, by will, gives to his 9 children 3648£. 14s. 3d. how much is it a piece? Ans. 405£. 8s. 3d.

Compound Division.

28. The Revolutionary war in America, commenced in the year 1775, how many years have passed since, it being the year 1831? Ans. 56 years.

29. Suppose a man leaves by will 6648 dollars, to be divided as follows, viz. one half to go to his widow, and the other half to be divided between his six children; what will the widow have and what is the share of each child?

Ans. The widow must have $3324, and each child $554.

To find the widow's share, divide the 6648 by 2; this quotient is the one half. After this, divide the other half, (or the last quotient, which is the same,) by 6; this quotient will be the share of each child.

30. Suppose 8 men gain 2226 dollars, what is each man's share? Ans. 278 dolls. 25cts.

When dividing by 8, there will be 2 remainder; here you may divide on, as though there were two ciphers in the place of cents, saying, thus with the 2 that is over; 8 into 20, twice and 4 over; then 8 into 40, five times and 0 over; so you will get for answer 278 dollars 25 cents, the cents were produced by adding the ciphers.

Or, you may put down $2226.00cts. and divide as directed.

31. What will 32 yards of broad-cloth come to, at $5.20cts. per yard? Ans. 166 dolls. 40cts.

REDUCTION.

Reduction teacheth to bring or change numbers of one denomination into others of different names or denominations, without altering their value.

Reduction is of two sorts; one, called, *Reduction descending;* the other *Reduction ascending.*

Reduction *descending*, is when a sum, having a greater name, is brought down into one of a less name; as pounds brought into shillings; dollars into cents; days into hours; &c. which is done by multiplying.

Reduction *ascending*, is when a sum, having a small name, is brought into one having a greater; as shillings into pounds; cents into dollars; hours into days, &c. this is done by dividing.

REDUCTION DESCENDING.

RULE.

Multiply the highest denomination, or greatest name given, by as many of the next less, as make one of that greater, ing in the less denomination, (if any,) then again by the lower denomination; and thus continue, till the whole is rec to the denomination required.

PROOF.

Change the order of the question, and divide your last product, by the last multiplier, and so on.

REDUCTION TABLES.

THE FOLLOWING TABLES, ARE GIVEN AS A KEY TO REDUCTION.

They will be found of great service to the learner, by showing what to multiply or divide by, to reduce, or bring one denomination into another; and at the same time giving the reason for so doing.

OF

	multipld	by 20 are shillings	ause	20 shillings	make	a pound
s		by 12 are pence		12 pence		a shilling
		by 4 are farthings		4 farthings		a penny
gs	divided	by 4 are pence	because	4 farthings	make	a penny
e		by 12 are shillings		12 pence		a shilling
.ings		by 20 are pounds		20 shillings		a pound
Dollars	multipld	by 100 are cents	because	100 cents	make	a dollar
Cents		by 10 are mills		10 mills		a cent
Mills	divided	by 10 are cents	because	10 mills	make	a cent
Cents		by 100 are dollars		100 cents		a dollar

TROY WEIGHT.

Pounds	multipld	by 12 are ounces	because	12 ounces	make	a pound
Ounces		by 20 are pennyweights		20 pennyweights		an ounce
Pennywts.		by 24 are grains		24 grains		a pennyweight
Grains	divide	by 24 are pennyweights	becau	24 grains	mak	a pennyweight
nnywts.		by 20 are ounces		20 pennyweights		an ounce

AVOIRDUPOIS WEIGHT.

Tons	multiplied	by 20 are hundreds	because	20 hundred wt.	make	a ton
Hundreds		by 4 are quarters		4 quarters		a hundred wt.
Quarters		by 28 are pounds		28 pounds		a qr. of an C.
Pounds		by 16 are ounces		16 ounces		a pound
Ounces		by 16 are drams		16 drams		an ounce
Drams	divided	by 16 are ounces	because	16 drams	make	an ounce
Ounces		by 16 are pounds		16 ounces		a pound
Pounds		by 28 are quarters		28 pounds		a quarter
Quarters		by 4 are hundreds		4 quarters		a hundred
Hundreds		by 20 are tons		20 hundreds		a ton

APOTHECARIES WEIGHT.

Pounds	multiplied	by 12 are ounces	because	12 ounces	make	a pound
Ounces		by 8 are drachms		8 drachms		an ounce
Drachms		by 3 are scruples		3 scruples		a drachm
Scruples		by 20 are grains		20 grains		a scruple
Grains	divided	by 20 are scruples	because	20 grains	make	a scruple
Scruples		by 3 are drachms		3 scruples		a drachm
Drachms		by 8 are ounces		8 drachms		an ounce
Ounces		by 12 are pounds		12 ounces		a pound

LONG MEASURE.

	multiplied	by 69½ are statute miles	because	69½ miles	make	a degree
		by 3 are miles		3 miles		a league
		by 8 are furlongs		8 furlongs		a mile
		by 40 are poles		40 poles		a furlong
		by 5½ are yards		5½ yards		a pole
[illegible]		by 3 are feet		3 feet		a yard
Feet		by 12 are inches		12 inches		a foot
Inches		by 3 are barley corns		3 barley corns		an inch
Barley corns	divided	by 3 are inches	because	3 barley corns	make	an inch
Inches		by 12 are feet		12 inches		a foot
Feet		by 3 are yards		3 feet		a yard
Yards		by 5½ are poles		5½ yards		a pole
Poles		by 40 are furlongs		40 poles		a furlong
Furlongs		by 8 are miles		8 furlongs		a mile
Miles		by 3 are leagues		3 miles		a league
Statute miles		by 69½ are degrees		69½ statute miles		a degree

CLOTH MEASURE.

Yards	multiplied	by 4 are quarters	because	4 quarters	make	a yard
Quarters		by 4 are nails		4 nails		a quarter
Ells Flemish		by 3 are quarters		3 quarters		an Ell Flemish
Ells English		by 5 are quarters		5 quarters		an Ell English
Ells French		by 6 are quarters		6 quarters		an Ell French

Quarters	divided	by 6 are Ells French	because	6 quarters	make	an Ell French
Quarters		by 5 are Ells English		4 quarters		an Ell English
Quarters		by 3 are Ells Flemish		8 quarters		an Ell Flemish
Nails		by 4 are quarters		4 nails		a-quarter
Quarters		by 4 are yards		4 quarters		a yard

LAND OR SQUARE MEASURE.

Acres	multiplied	by 4 are roods	because	4 roods	make	an acre
Roods		by 40 are rods or poles		40 poles		a rood
Poles or rods		by 30¼ are yards		30¼ yards		a rod
Yards		by 9 are square feet		9 square feet		a yard
Feet		by 144 are square inches		144 square inches		a foot

Inches	divided	by 144 are square feet	because	144 inches	make	a square foot
Feet		by 9 are yards		9 square feet		a yard
Yards or poles		by 30¼ are rods		30¼ square yards		a rod
Rods or poles		by 40 are roods		40 poles		a rood
Roods		by 4 are acres		4 roods		an acre

LIQUID MEASURE.

	multiplied	by 4 are hogsheads	because	4 hogsheads	make	a tun
of wine		by 63 are gallons		63 gallons		a hhd
of beer		by 54 are gallons		54 gallons		a hhd
Bls of beer		by 36 are gallons		36 gallons		a barrel
Bls of ale		by 32 are gallons		32 gallons		a barrel
Bls of wine		by 31½are gallons		31½gallons		a barrel
Gallons		by 4 are quarts		4 quarts		a gallon
Quarts		by 2 are pints		2 pints		a quart
Pints		by 4 are gills		4 gills		a pint
Gills	divided	by 4 are pints	because	4 gills	make	a pint
Pints		by 2 are quarts		2 pints		a quart
Quarts		by 4 are gallons		4 quarts		a gallon
Gallons		by 31½are bls of wine		31½gallons		a barrel
Gallons		by 32 are bls of ale		32 gallons		a barrel
Gallons		by 36 are bls of beer		36 gallons		a oarrel
Gallons		by 54 are hhds of beer		54 gallons		a hogshead
Gallons		by 63 are hhds of wine		63 gallons		a hogshead
Hogsheads		by 4 are tuns		4 hogsheads		a tun

DRY MEASURE.

Chaldrons	multiplied	by 36 are bushels	because	36 bushels	make	a chaldron
Quarters		by 8 are bushels		8 bushels		a quarter
Bushels		by 4 are pecks		4 pecks		a bushel
Pecks		by 8 are quarts		8 quarts		a peck
Quarts		by 2 are pints		2 pints		a quart
Pints	divided	by 2 are quarts	because	2 pints	make	a quart
Quarts		by 8 are pecks		8 quarts		a peck
Pecks		by 4 are bushels		4 pecks		a bushel
Bushels		by 8 are quarters		8 bushels		a quarter
Bushels		by 36 are chaldrons		36 bushels		a chaldron

SOLID MEASURE.

Cords	multiplied	by 128 are feet	because	128 feet	make	a cord
Tons of hewn timber		by 50 are feet		50 feet		a ton
Tons of round timber		by 40 are feet		40 feet		a ton
		by 1728 are solid inches		1728 inches		a foot
Feet	divided	by 1728 are solid feet	because	1728 inches	make	a foot
Inches		by 40 are tons of round timber		40 feet		a ton
Feet		by 50 are tons of hewn timber		50 feet		a ton
Feet		by 128 are cords of wood		128 feet		a cord

TIME.

	multiplied	by 365¼ are days	because	365¼ days	make	a year
		by 4 are weeks		4 weeks		a month
		by 7 are days		7 days		a week
		by 24 are hours		24 hours		a day
Hours		by 60 are minutes		60 minutes		an hour
Minutes		by 60 are seconds		60 seconds		a minute

NOTE.—Years multiplied by 52, are weeks; and years multiplied by 12 are months.

Seconds	divided	by 60 are minutes	because	60 seconds	make	a minute
Minutes		by 60 are hours		60 minutes		an hour
Hours		by 24 are days		24 hours		a day
Days		by 7 are weeks		7 days		a week
Weeks		by 4 are months		4 weeks		a month
Weeks		by 52 are years		52 weeks		a year

MOTION.

Signs	multipld	by 30 are degrees	because	30 degrees	make	a sign
Degrees		by 60 are minutes		60 minutes		a degree
Minutes		by 60 are seconds		60 seconds		a minute
Seconds	divided	by 60 are minutes	because	60 seconds	make	a minute
Minutes		by 60 are degrees		60 minutes		a degree
Degrees		by 30 are signs		30 degrees		a sign

I wish it to be impressed upon the mind of the learner, that he ought to understand what he does, as he progresses; which he may do by paying particular attention to the rules and tables. By these he may know what to do, and the reason why he does it.

The rule for Reduction descending, has been given—the following is intended as a further explanation of the rule.

Suppose pounds are given to be reduced to pence, how is it to be done? pence is a less name than pounds, consequently the pounds must be multiplied. The question arises by what? and in order to answer that; another may be asked what is the next lower name to pounds? the answer is shillings; then to reduce pounds into shillings, multiply by the number of shillings in a pound. Again, what is the next lower name to shillings? the answer is pence; then multiply the shillings by the number of pence in a shilling, and the result will be the number of pence.

Again, suppose dollars are given to be reduced into mills; how is it performed? first, consider what the next lower denomination to dollars is, it is cents; then, to reduce dollars to cents, multiply by the cents in a dollar: the product will be the number of cents in the dollars. Again, what is the next lower name to cents? it is mills, then the cents must be multiplied by the number of mills in a cent; the last product will be the mills required. It might be done by reducing the dollars to dimes, the dimes to cents, and the cents to mills.

EXAMPLE FOR ILLUSTRATION.

1. Reduce 26£. 17s. 4d. 1qr. into shillings, pence and farthings. Ans. 537s. 6448d. 25793qrs.

£.	s.	d.	qr.
26	17	4	1
20			
537 shillings.			
12			
6448 pence.			
4			
25793 farthings.			

Here, I multiplied by 20 under the pounds; because, 20 shillings make a pound; the 17 shillings in the question I added in, when I multiplied by 20; otherwise, it would have only brought the shillings in 26 pounds; but the question required the shillings in 26£. 17s. when I multiplied by the 20, I said 0 is an 0, and 7 (the units place of the shillings,) is 7; twice 6 are 12, and 1 (in t[illegible]ns place of the shillings,) are 13; set down 3 and carry 1; twice 2 are 4, and 1 are 5, this produced 537 shillings. I next proceeded to bring the shillings into pence, by multiplying by 12, the pence in a shilling, adding in the 4 pence in the question; then, to bring the pence into farthings, I multiplied by 4, because, 4 farthings make a penny; adding in the 1 farthing in the given sum, this produced 25793qrs. which was the answer required.

For the *proof of questions* in this rule, see Reduction ascending.

2. Reduce 265 dollars 72 cents into cents.
Ans. 26572 cents.

$ cts.
265.72
100
———
26572 cents.
———

I multiplied by 100, the cents in a dollar, and added in the 72 cents. Here, you will see, that although I multiplied by 100, and added in the cents, the figures are the same as in the given sum. Then to reduce dollars and cents to cents, only remove the point, and the whole will be cents. Or, to reduce dollars, cents and mills, to mills; remove the points, and the whole will be mills. But, that the learner may understand the nature of Reduction of Federal money, the examples are given to be reduced by multiplying, by the number belonging to each denomination.

3. Reduce 39 dollars 36 cents 2 mills into mills.
Ans. 39362 mills.

$ cts. m
39 . 36 . 2
100
———
3936 cents.
10
———
39362 mills.
———

In the first place, I multiplied by 100, because, 100 cents make a dollar, adding in the 36 cents; then by 10, because 10 mills make a cent; this brought 39362 mills, the same figures as in the given sum.

EXAMPLES.

4. Reduce $38.50cts. to cents. Ans. 3850 cents.
Dollars multiplied by — are cents, because — cents make a dollar. See the table.

5. Reduce 48 dollars into mills. Ans. 48000.
Dollars multiplied by — are cents, cents multiplied by — are mills.

6. Reduce 24£. into shillings and pence. Ans. 480s. 5760d.
Pounds multiplied by — are shillings, shillings multiplied by — are pence.

7. Reduce 108£. 16s. 5d. 3qrs. into quarters.
Ans. 104471 qrs.
Pounds multiplied by — are shillings, shillings multiplied by — are pence, pence multiplied by — are quarters. When you multiply by 20, remember to add in the 16s. when by 12, the 5d. and when by 4, the 3 qrs.

8. Reduce 46£. 12s. 4d. ½ into half pence.
Ans. 22377 half pence.
Reduce the question into pence as before, then multiply by the number *of half pence* in a penny, adding in the 1 for the half penny in the

9. Reduce the $29.36cts. 8m. into mills. Ans 29368 mills.

Dollars multiplied by — are cents, cents multiplied by — are mills.

10. Reduce 24 guineas at 21 shillings each into pence.
Ans. 6048 pence.

After you have brought the guineas into shillings; then, shillings multiplied by — are pence.

11. Reduce 250 dollars at 8s. each, into farthings.
Ans. 96000qrs.

Find the number of shillings in the 350 dollars, then shillings multiplied by — are pence, pence multiplied by — are farthings.

12. Reduce 16s. 4d. 1qr. into quarters. Ans. 785qrs.

The question is already in shillings, &c.; shillings multiplied by — are pence, pence multiplied by — are quarters.

13. Reduce 145 French crowns, at 8s. 10d. each, into farthings. Ans. 61480 farthings.

Reduce the 8s. 10d. into pence; then multiply the result under the crowns, this will bring the pence in the crowns; then pence multiplied by — are farthings.

14. Reduce 568 dollars at 6s. each, into farthings.
Ans. 163584 farthings.

See example 11th.

15. Reduce 17s. 2d. into farthings. Ans. 824 farthings.

Shillings multiplied by — are pence, pence multiplied by — are farthings.

16. Reduce 21£. 6s. and 2£. 9s. 7d. 2qrs. into farthings separately. Ans. 20448qrs. and 2382qrs.

Pounds multiplied by — are shillings, &c. add in the shillings, &c.

17. How many cents are there in 48 guineas, each 444 cents?
Ans. 21312 cents.

Guineas ——— by 444 are cents.

18. Reduce 109D. 3cts. 4m. into mills. Ans. 109034 mills.

Dollars multiplied by — are cents, cents multiplied by — are mills.

19. Reduce 202 dollars into mills. Ans. 202000 mills.

20. Reduce $46.09cts. 3m. and 97cts. 5m. into mills separately. Ans. 46093 mills and 975 mills.

The last mentioned is already cents, the next lower name is mill[illegible]he first mentioned to be done as before.

21. Reduce 29 moidores at 27 shillings each into pence.
Ans. 9396d.

Reduce the moidores into shillings, then shillings multiplied by — are pence.

22. Reduce 1£. and 12£. 13s. 8d. into pence separately.
Ans. 240d and 3044d.

Ask yourself the question, how shall I reduce pounds into pence? If you have been attentive to the rules, &c. I think you can do this question. Try.

23. Reduce 27£. 9s. 6d. into sixpences.
Ans. 10

Reduce this question into shillings, then ask yourself how many sixpences are there in a shilling; multiply by the number, and add in one for the sixpence in the question.

24. How many three pences are there in 18£. 12s. 9d?

Ans. 1491 threepences.

Reduce this into shillings as before, then multiply by the number of three pences in a shilling, add in 3 for the three pences in 9d.

25. Reduce 2£. 16s. 3d. and 19s. 5d. into pence separately.

Ans. 675d. and 233d.

26. Reduce 11 eagles 9 dollars 6 dimes 8 cents 3 mills into mills. Ans. 119683 mills.

By the table you will see how many dollars make an eagle, how many dimes make a dollar, &c.

REDUCTION ASCENDING.

RULE.

Divide the given sum, or lowest denomination, by as many of its own name as make one of the next greater, and so on from one denomination to another, till you get the question into the name or denomination required.

PROOF.

Reduce the answer back to the name, or denomination, given in the question. See Reduction descending.

NOTE.—You will see that this rule is performed by Division; for the questions are given in a smaller name to be brought into a greater, and I think you may know by this time, that farthings are a less name than pounds, mills a less name than dollars, &c.

Observe.—To bring farthings into pence, divide by as many farthings as make a penny; to bring pence into shillings, divide by as many pence as make a shilling; to bring shillings into pounds, divide by as many shillings as make a pound; to bring mills into cents, divide by as many mills as make a cent; to bring cents into dollars, divide by as many cents as make a dollar, and so with any other name or denomination.

EXAMPLES FOR ILLUSTRATION.

In 25793qrs. how many pence, shillings and pounds.

Ans. 26£. 17s. 4d. 1qr.

```
 Farthings.
 4|25793
  |------
12| 6448       1 qr.
  |------
2|0| 53(7   4   1
  |------
  | 26   17   4   1
                  qr.
```

I first divided by 4, the farthings in a penny; this brought 6448 pence and 1 remainder, this 1 is a farthing;* as the given sum was farthings, I set the 1 a little distance from the pence. I next divided by 12, because 12 pence make a shilling; this brought 537 shillings and 4 pence remainder, which I set a little distance from the shillings, placing the 1 farthing near the 4 pence; then to bring the shillings into pounds, I divided by 20, because 20 shillings make a pound; this brought 26 pounds and 17 shillings remainder; the shillings I set down as in the margin, and brought the pence and farthings down in a line with them; the result was the answer, viz. 26£. 17s. 4d. 1qr.

---

*[illegible] be a remainder when dividing, it is of the same

Observe.—When I divided by 20, I cut off the cipher in the divisor; likewise a figure in the dividend, (as before taught,) and divided by the 2. When dividing by this, there was 1 remainder, which I called 10, and added it to the 7 cut off, which made 17 shillings; this would have been the remainder, had I divided without cutting off.

This question proves the first example for illustration in Reduction descending.

2. In 26572 cents, how many dollars and cents?

Ans. $26572 cents.

```
   cents
1|00)265(72
    ------
     265 . 72
      $.   cts.
```

In this example, I divided by 100, because 100 cents make a dollar; this brought 265 dollars 72 cents the answer.

```
100)26572(265
     200   dolls.
    ----
     657
     600
     ----
      572
      500
      ----
       72 cents
      ----
```

Note.—To bring cents into dollars, nothing more is required to get the answer, than to point off two figures from the right towards the left. You will see, that if, from 26572 cents, two figures be pointed off as directed, it will stand thus; 265.72 that is, 265 dolls. 72 cts. the answer as before.

Observe once more. When the question is given in mills, point off one figure from the right towards the left for mills, then two for cents. By pointing off as here directed, you will get the same answer as dividing by 10, the mills in a cent, and 100 the cents in a dollar.

In the following examples of Federal money, the learner may divide by the number belonging to each denomination, that he may the better understand the rule.

3. Bring 39362 mills into dollars. Ans. 39D. 36cts. 2m.

```
       mills.
1|0   |3936|2
      |---------
1|00  |39|36 . 2
      |---------
      |39 . 36 . 2
      |D    cts  m
```

To find the answer to this question, I first divided by the mills in a cent, then by the cents in a dollar; now, had I pointed off one figure for mills, and then two for cents, it would have stood thus; 39.36.2, the same result, viz. 39 dollars, 36cts. 2m.

EXAMPLES.

4. Bring 3850 cents into dollars. Ans. 38D 50cts.

Cents divided by — are dollars, because — cents are a dollar.

Note.—In this rule, divide by the same denominations that you multiplied by in the last, beginning at the lowest name.

5. Bring 48000 mills into dollars. Ans. 48 dollars.

Mills divided by — are cents, cents divided by — are dollars.

6. In 5760 pence, how many shillings and pounds? Ans. 480s. 24£.

Pence divided by — are shillings, shillings divided by — are pounds.

7. Bring 104471 qrs. into pounds &c. Ans. 108£. 16s. 5d. 3qrs.

Farthings divided by — are pence, pence divided by — are shillings, shillings divided by — are pounds.

8. Find how many pounds &c. are in 22377 half pence. Ans. 46£. 12s. 4½d.

In the first place, divide by the half pence in a penny, there will be one remainder, and as the given sum is half pence, this of course is a half penny, put it down as such. Then pence divided by— are shillings, shillings divided by — are pounds.

9. Bring 29368 mills into dollars. Ans. 29D. 36cts. 8m.

Mills divided by — are cents, &c.

10. In 6048 pence, how many shillings and guineas at 21 shillings each? Ans. 24 guineas.

Pence divided by — are shillings, then bring the shillings into guineas.

11. Bring 96000 farthings into dollars at 8s. each. Ans. 250 dollars.

Farthings divided by — are pence, pence divided by — are shillings, then —— by the number of shillings in the dollar.

12. How many pounds, &c. are there in 785 farthings? Ans. 16s. 4d. 1qr.

Remember that farthings divided by — are pence, and so on. Try.

13. Bring 61480 farthings into French crowns, at 8s. 10d. each. Ans. 145 French crowns.

Brin [illegible] pence. Reduce the 8s. 10d. into pence, and [illegible] last mentioned.

14. In 163584 farthings, how many dollars, at 6s. each?
Ans. $568

Farthings divided by — are pence, pence divided by — are shillings, then —— by the shillings in a dollar.

15. Bring 824 farthings into pounds. Ans. 0£. 17s. 2d.

Farthings divided by — are pence, &c.

16. Bring 20448 farthings, and 2382qrs. into pounds.
Ans. 21£. 6s. and 2£. 9s. 7d. 2qrs.

— Farthings make a penny — pence a shilling, &c. find the answers separately.

17. How many guineas each 444 cents are there in 21312 cents? Ans. 48 guineas.

Divide by the number of cents given for a guinea.

18. Bring 109034 mills into dollars. Ans. $109·03cts 4m.

Mills divided by — are cents, &c.

19. Bring 202000 mills into dollars. Ans. 202 dolls.

20. Bring 46093 mills and 975 mills into dollars separately.
Ans. $46.09cts. 3m. and 97cts. 5m.

21. How many moidores each 27s. are there in 9396 pence?
Ans. 29 moidores.

Pence divided by — are shillings, then shillings ——— by 27 are moidores.

22. Bring 240 pence and 3044 pence into pounds separately.
Ans. 1£. and 12£. 13s. 8d.

Pence divided by 12 are shillings, &c.

23. Bring 1099 sixpences into pounds. Ans. 27£. 9s. 6d.

Divide by the sixpences in a shilling, then shillings divided by — are pounds. If there be a remainder, when you divide by the number of sixpences in a shilling, it will be so many sixpences.

24. In 1491 three pences, how many pounds?
Ans. 18£. 12s. 9d.

——— By the three pences in a shilling, then shillings divided by — are pounds. If there be a remainder it will be so many three pences.

25. Bring 675 pence, and 233 pence, into pounds separately.
Ans. 2£. 16s. 3d. and 19s. 5d.

26. Bring 119683 mills into eagles.
Ans. 11E. 9dolls. 6d. 8[illegible]m

——— by the mills in a cent, the cents in a dime, the dimes in a dollar, &c.

Reduction Ascending and Descending.

OF MONEY.

The learner will have to exercise his judgment in the following cases of Reduction, as both multiplication and division are used according to the nature of the question.

Note.—When a greater number is required, multiply; when a less, *divide; for example, suppose you have days to bring into hours.* It will be readily perceived that the answer must be greater, consequently you must multiply; or suppose minutes are to be brought into hours. It is evident that division must be used, for there must be less hours than there are minutes.

If any difficulty arises, turn back and review the rules, tables, &c.

EXAMPLES FOR ILLUSTRATION.

1. Bring 36956 farthings into pounds. Ans. 38£. 9s. 11d.

4)36956

12)9239

2(0) 76(9 11

38 9 11

£. s. d.

Here I used Division, as it was plain that there must be less pounds than farthings. I, therefore, divided by 4, the farthings in a penny; 12, the pence in a shilling; and 20, the shillings in a pound.

2. Reduce 38£. 9s. 11d. into farthings.

Ans. 36956 farthings.

£. s. d.

38 9 11

20

769

12

9239

4

36956

To reduce pounds &c. to farthings, multiplication must be used, as there will be more farthings than pounds; accordingly I multiplied by 20, the shillings in a pound; 12, the pence in a shilling; and 4 the farthings in a penny; adding in the shillings and pence in their proper places.

3. In 168£. how many shillings, and English guineas, at 21 [illegible]gs each. Ans. 3360£. 160 guineas.

£

168

20

21)3360(160

21 guineas.

126

In this question, multiplication and division both are to be used; first to bring the pounds into shillings, then the shillings into guineas.

NOTE.—When you divide by shillings, the sum to be divided must be shillings; when by pence, the sum must be pence, &c.

EXAMPLES.

4. In 30720 pence, how many shillings and dollars, at 8s. each? Ans. 2560s. 320 dollars.

Pence divided by — are shillings; because — pence make a shilling, then divide by the shillings in a dollar.

5. In 28£. how many dollars, at 8 shillings each? Ans. 70 dollars.

Reduce the pounds to shillings; then ——— by the shillings in the dollar.

6. In 94£. 4s. how many dollars at 6s. each? Ans. 314 dollars.

7. In 41£. 12s. 6d. how many dollars at 7s. 6d. each? Ans. 111 dollars.

Bring the given sum into pence; remember pounds multiplied by — are shillings, &c. then divide by the pence in 7s. 6d.

8. In 14£ how many shillings, pence and dollars, at 4s. 8d. each? Ans. 280s. 3360d. 60 dollars.

Divide the pence in 14£. by the pence in 4s. 8d.

9. [illegible] guineas at 37 shillings each, how many pistareens at 16 pence each? Ans. 2220.

Divide the pence in 80 guineas, by the pence in a pistareen.

10. In 48 dollars at 6 shillings each, how many dollars at 8 shillings each? Ans. 36 dollars.

Multiply by the shillings in a dollar of the first mentioned, and——— by the shillings in a dollar of the last mentioned.

11. In 3744 pence, how many shillings, three pences and six pences? Ans. 312s. 1248 three pences, 624 six pences.

Pence divided by — are shillings; then multiply by the three pences in a shilling, and ——— by the three pences in six pence.

12. If your purse contains 40 half eagles, how many half dollars can you get in exchange for them? Ans. 400 half dollars.

How is this to be done? half eagles multiplied by — are dollars; then —— by as many half dollars as make a dollar.

13. In 47616 farthings, how many pence, shillings and [illegible]lars, at 8s. each? Ans. 11904 pence, 992 shilli[illegible]124 do[illegible]

Bring the farthings into shillings, then —— by the shillings in the dollar.

14. Which contains the most pounds, 8200 farthings, or 1810 pence? Ans. The first contains 1£. the most.

Bring the farthings into pounds, then bring the pence into pounds, and subtract the less from the greater.

15. Find how many six pences, pence, and farthings, there are in 7£. 10s. Ans. 300 six pences, 1800d. 7200 qrs.

Bring the given sum into shillings, then —— by the sixpences in a *shilling, the pence in sixpence,* and the farthings in a penny.

16. Suppose you have 840 quarter of a dollar pieces, how many half eagles are they worth? Ans. 42 half eagles.

How many quarter of a dollar pieces make a dollar?—what next?—bring the dollars into half eagles.

17. In 96 dollars at 8s. each, how many shillings, pence, and farthings? Ans. 768s. 9216pence, 36864farthings.

18. In 100 English guineas, each 4 dollars 44cts. or 444cts. how many eagles? Ans. 44E. 4 dolls.

Find the cents in the guineas, then cents divided by — are dollars, &c.

19. In 48968 half cents, how many dollars? Ans. 244 dollars 84cts.

How many half cents make a cent? How many cents make a dollar?

20. Bring 38 dollars 42½ cents into half cents. Ans. 7685 half cents.

Dollars multiplied by — are cents, then —— by the half cents in a cent, add in 1 for the half cent.

21. In 31104 half pence, how many pounds? or how many dollars, at 8s. each? Ans. 64£. 16s. or 162 dollars.

Bring the half pence into shillings, then ——— by the shillings in a pound, and ——— the same sum by the shillings in the dollar.

22. How many dollars at 8s. each, or 6s. each, are there in 300 £? Ans. 750 dollars at 8s. or 1000 dollars at 6.

You must ——— the shillings in the given sum by the shillings given to the dollar separately.

23. How many dollars at 7s. 6d. each, or at 4s. 6d. each, are there in 225£? Ans. 600 at 7s. 6d. or 1000 at 4s. 6d.

——— the pence in the given sum by the pence in the dollar separately.

24. If 6 men carry 240 dollars worth of silver to the mint, to be coined into dimes, (or 10 cent pieces,) how many must each man have? Ans. 400 dimes each.

The cents in the given sum ——— by the cents in a dime, then ——— by the number of men.

25. How many half dollars, quarter dollars, and ten cent [illegible]es, are t[illegible] in $150.45cts. and the number of each equal? Ans. 177 of each.

The cents [illegible] given sum ——— by the number of cents in a half dollar, quarter of a dollar, and a ten cent piece added together.

26. In 48242 half pence, how many pounds? Ans. 100£. 10s. 1d.

Half pence divided by —— are pence; pence divided by —— are shillings, &c.

27. If a man is indebted to his landlord for 6 years rent, at 50 cents per year, how many eagles will pay the Ans. 21 eagles 3 dollars.

in the whole rent for 6 years ——— by the dollars in

28. How many pounds are there in 220 dollars at 8s. each? Ans. 88£.
29. In $498 how many cents? Ans. 49800 cts.
30. In $498 how many mills? Ans. 498000 m.
31. Bring 94684 mills into dollars. Ans. $94.68cts. 4m.
32. Reduce $695.42cts. 4 m. into mills. Ans. 695424m.
33. In 16cts. 9m. how many mills? Ans. 169 m.
34. Reduce a dollar to mills. Ans. 1000m.
35. In 4936 dimes how many eagles? Ans. 49E. 3D. 6 dimes.
36. Reduce $28.04cts. into cents. Ans. 2084cts.

TROY WEIGHT.

You must endeavour to know what the question requires, to do this, Observe.—To bring pounds into ounces, multiply by as many ounces as make a pound. To reduce pounds to grains, first reduce the pounds to ounces; then the ounces to pennyweights, and the pennyweights to grains; which is done by multiplying by the denominations belonging to each; to bring grains into pounds, divide by the same figures, beginning with the lowest denomination. Examine Troy Weight tables.

EXAMPLES FOR ILLUSTRATION.

1. In 12lb. 11oz. 9pwts. 3 gr. of silver how many grains. Ans. 76419 grains.

lbs. oz. pwt. gr
12 11 9 3
12

155
20

3109
24

12439
6218

74619 grains.

Here you will see the question worked at large. The operation was as follows; I first placed the lbs. oz. pwts. and gr. down in order, and then proceeded to multiply by 12, because 12 ounces make a pound Troy, adding in the 11 ounces. I then multiplied by 20, the pennyweights in an ounce, adding in the 9 pennyweights; and, lastly, by 24, the grains in a pennyweight, adding in the 3 grains; the last product was the number of grains required.

2. In 74619 grains of silver, how many lbs?

Ans. 12lbs. 11oz. 9pwt 3gr.

```
grains.
24)74619(2|0|310|9
  72      12|———
  ———        155   9
   26        ———
   24         12  11   9   3
  ———        lbs. oz. pwt. gr.
   219
   216
  ———
     3 grains.
  ———
```

This example proves the last, and is performed as you see in the margin. As the question was given in grains, I divided by 24, because 24 grains make a pennyweight; this brought 3109 pennyweights, and 3 grs. remainder; I then divided by 20, the pennyweights in an ounce; this brought 155 ounces, and 9 pennyweights remainder. In the last place, I divided by 12, the ounces in a pound; the quotient was 12lbs. and 11 ounces over; so that the whole brought, (placed in order,) 12lbs. 11 ounces 9 pwts. 3 qrs. which was the answer.

EXAMPLES.

3. In 8lb. 10oz. of silver how many grains?

Ans. 50880 grains.

Pounds multiplied by —— are ounces, ounces multiplied by —— are pennyweights, pennyweights multiplied by —— are grains.

4. In 50880 grains of silver, how many lbs?

Ans. 8lb. 10 ounces.

Grains divided by —— are pennyweights, pennyweights divided by —— are ounces, ounces divided by —— are pounds.

5. In 4720 grains of gold, how many pounds?

Ans. 0lb. 9oz. 16pwt. 16 grains.

Grains divided by —— are pennyweights, pennyweights divided by —— are ounces, ounces divided by —— are pounds.

6. In 192 ounces of silver, how many grains?

Ans. 92160 grains.

Ounces multiplied by —— are pennyweights, pennyweights multiplied by —— are grs.

7. If a silver tea-set weigh 992 pennyweights, how many lbs. of silver in the whole? Ans. 4lb. 1oz. 12pwts.

Pennyweights divided by —— are ounces, ounces divided by —— are pounds.

8. Suppose you have a quantity of silver which weighs 3lb. oz. 17pwts. 12grs. and you wish a silversmith to make them o table spoons, each to weigh 3oz. 1pwt. 11qrs. how many ld you have? Ans. 12 table spoons

weight of the silver into grains, and the weight of the ins, and divide by the last mentioned.

9. If a goldsmith has 2 ingots of gold, each weighing 5 oz. 9pwt. 14gr. and has a mind to make them up into the following articles, viz. watch chains to weigh 770 grains, watch seals to weigh 392 grains, and pencil cases to weigh 153 grains, and to have an equal number of each; how many will there be of each sort? Ans. 4 of each.

Reduce the weight of an ingot to grains, and multiply by the number of ingots; then divide by the number of grains it takes to make one of each kind; the quotient will be the answer.

AVOIRDUPOIS WEIGHT.

To find the answer of the following questions, attend to the observations, tables, &c. already given.

EXAMPLES FOR ILLUSTRATION.

1. In 6C. 3qrs. 17lb. 11oz. 14dr. how many drams?

Ans. 198078 drams.

C.	qrs.	lbs.	oz.	dr.
6	3	17	11	14

4

27 qrs.
28

223
55

773 lbs.
16

4639
774

12379 oz.
16

74278
12380

198078 drs.

To find the number of drams, I first multiplied by 4, the quarters in a hundred weight, adding in the 3 qrs. in the question; this produced 27 qrs. I then multiplied by 28, because 28lbs. make a quarter of a cwt. and added in the 17lbs. this produced 773lbs. then I multiplied by 16 the ounces in a lb. adding in the 11oz. this produced 12379oz. and lastly, I multiplied by 16, the drams in an oz. adding in the 14 drams; this produced 198078 drams, the answer required.

2. In 198078 drams, how many cwt?

Ans. 6C. 3qrs. 17lb. 11oz. 14drs.

drams ounces pounds quarters
16)198078(16)12379(28)773(4)27
16 112 56
6 3 17 11 14
38 117 213 C. qrs. lbs. oz. dr.
32 112 196
60 59 17 lbs.
48 48
127 11 ounces.
112
158
144
14 drams.

I divided the drams by 16, why? because 16 drams make an ounce; the quotient was 12379 ounces, and 14 drams remainder. I then divided the ounces by 16, the ounces in a lb. this brought 773 pounds, and 11 ounces over; I next divided by 28, the pounds in a quarter of a cwt. and got 27 quarters and 17lbs. remainder; lastly, I divided the 27 quarters by 4, the quarters in a cwt. and this brought 6C. and 3 quarters over; the answer, when arranged in order, was 6C. 3qrs. 17lbs. 11oz. 14 drams; this question proves the last.

EXAMPLES.

3. In 2C. 1 qr. 12lbs. 9oz. 11dr. how many drams?

Ans. 67739.

Cwt. multiplied by —— are quarters, quarters multiplied by —— are pounds, pounds multiplied by —— are ounces, ounces multiplied by —— are drams.

4. In 67739 drams, how many cwt?

Ans. 2C. 1qr. 12lbs. 9oz. 11dr.

Drams divided by —— are ounces, ounces divided by —— are pounds, pounds divided by —— are quarters, quarters divided by —— are cwt.

5. In 5 tons, how many lbs? Ans. 11200lbs.

by —— are hundreds, hundreds multiplied by ——
s multiplied by —— are pounds.

6. In 11200lbs. how many tons? Ans. 5 tons.

Pounds divided by —— are quarters, quarters divided by —— are hundreds, &c.

7. In 4C. 3qrs. 12lbs. how many pounds? Ans. 544.

Hundreds multiplied by —— are quarters, &c.

8. In 5 barrels of sugar, each 2C. 2qrs. 14lbs. how many lbs? Ans. 1470lbs.

Reduce the 2C. 2qrs. 14lbs. to pounds, as in the last example; this will bring the lbs. in one barrel; then ———— by the number of barrels.

9. In 16lbs. 14oz. how many drams? Ans. 4320 drams.

Pounds multiplied by —— are ounces, &c.

10. In 3C. 2qrs. 8lbs. of raisins, how many boxes, each 25lb. Ans. 16 boxes.

Reduce the 3C. 2qrs. 8lbs. into lbs. and then ———— by the lbs. in a box.

11. In 13 pigs of lead, each 3C. 2qrs. how many fother, each 19C. 2qrs. Ans. 2 fother 6C. 2qrs.

Reduce the 3C. 2qrs. into quarters; cwt. multiplied by —— are qrs. then multiply by the number of pigs; reduce the 19C. 2qrs. into qrs. and divide by this product.

NOTE.—The remainder will be quarters, which divide by the quarters in a cwt.

12. In 22 boxes of sugar, each weighing 158lbs. how many cwt? Ans. 31C. 0qrs. 4lbs.

———— the lbs. by the number of boxes, the product will be pounds; then, to bring the lbs. into cwt. divide by the lbs. in a qr. and the qrs. in a cwt.

13. How many 2½lb. canisters can be filled from 3C. 3qrs. 15lbs. of tea? Ans. 174 canisters.

Find the pounds in 3C. 3qrs. 15lbs. reduce them to half pounds, and ———— by the half pounds in 2½ lbs.

14. Bring 69348 ounces into tons. Ans. 1T. 18C. 2qrs. 22lbs. 4oz.

Ounces divided by —— are pounds, pounds divided by —— are quarters, &c.

APOTHECARIES WEIGHT.

EXAMPLES.

1. In 8lbs. 3℥. 6ʒ. 2℈. 8gr. how many grains? Ans. 47928 grains.

Pounds multiplied by —— are ounces; ounces multiplied by —— are drachms, &c. mind and bring in the ounces, &c.

2. In 47928 grains, how many ℔? Ans. 8℔. 3℥. 6ʒ. 2℈. 8gr.

Grains divided by —— are scruples; scruples divided by — *drachms, &c.* Place the remainders as before taught.

LONG MEASURE.

Pay attention, and try to understand all you do; when you multiply or divide by any figure, endeavour to know the reason why you do it.

EXAMPLES FOR ILLUSTRATION.

1. In 1 mile, how many barley corns? Ans. 190080 b. corns.

Mile.
1
8

8 furlongs.
40

½|320 rods or poles.
5½

1600
160

1760 yards.
3

5280 feet.
12

63360 inches.
3

190080 barley corns.

To find the answer to this question, I multiplied by 8, the furlongs in a mile; by 40, the poles in a furlong; by 5½, the yards in a pole; by 3, the feet in a yard; then, by 12, the inches in a foot; and lastly, by 3, the barley corns in an inch. You will see that 1 mile contains 8 furlongs, 320 rods or poles, 1760 yards, 5280 feet, 63360 inches, and 190080 barley corns.

Note.—I multiplied by 5½, as directed in the 2d example for illustration, p. 60.

2. In 190080 barley corns, how many miles? Ans. 1 mile.

Barley corns.
3|190080

1[illegible]|63360

5280

1760(1 mile.
[illegible]60

Here I divided by 3, the barley corns in an inch; by 12, the inches in a foot; by 3, the feet in a yard; lastly, by 1760, the yards in a mile; which brought the answer. I divided by 1760, instead of dividing by 5½, the yards in a pole, &c.

```
yds.        Barley corns.
 5½     3|190080
 2       |------
----    12| 63360 inches.
 11      |------
        3|  5280 feet.
         ------
            1760 yards.
               2
         ------
       11|  3520
         |------
      4|0|   32|0 rd.or po.
         |------
        8|     8 furlongs.
         |------
             1 mile.
```

To divide by 5½, the work is done as in the margin. As before, I divided by the barley corns in an inch, the inches in a foot, and the feet in a yard; and then, in order to divide by 5½, the yards in a pole, I reduced the 5½ yards into half yards; and the last quotient, the 1760 yards into half yards; and then, I divided by the half yards in a pole; this brought 320 rods or poles, which I divided by 40, the poles in a furlong, and 8, the furlongs in a mile; this brought the same answer as before, viz. 1 mile.

EXAMPLES.

3. In 40 miles, how many furlongs, poles and yards? Ans. 320fur. 12800po. 70400yds.

Miles multiplied by —— are furlongs; furlongs multiplied by —— are poles; poles multiplied by —— are yards.

4. In 14 feet 6 inches, how many inches? Ans. 174 inches.

Feet multiplied by —— are inches; add in the 6 inches.

5. In 36 miles, how many inches? Ans. 2280960 inches.

Miles multiplied by —— are furlongs, and so on, till you get to feet, which multiplied by —— are inches.

6. In 20 rods or poles, how many barley corns? Ans. 11880

Poles multiplied by —— are yds. yds. multiplied by —— are feet, &c.

7. In 2400 inches, how many yards? Ans. 66yds. 2ft.

Inches divided by —— are feet; feet divided by —— are yards.

8. How many times will the wheel of a carriage, which is 14 feet 6 inches, turn between New-York and Huntington, computing the distance at 36 miles? Ans. 13108 times & 168in. over.

Divide the inches in the 36 miles by the inches in the 14ft. 6in.

9. How many inches will reach round the globe [illegible]h is 360 degrees, and each degree 69½ miles? Ans. 1[illegible]07200

Degrees multiplied by —— are miles; miles multiplied by —— are furlongs, &c. till you get to feet, which multiplied by —— are inches.

10. Suppose that when travelling a certain road in a carriage, you took the pains to count the number of times one of the wheels, which measured 15 feet 9 inches round, or in *circumference,* turned between two particular places, and foun

that it turned 3784 times, how many miles were those places apart? Ans. 11m. 2f. 12p.

You must —— the inches round the wheel by the number of times the wheel turned, this will produce the number of inches the places are apart, which bring into miles; inches divided by — are feet; feet divided by — are yards; here you may bring the yards into half yards, and divide by the half yards in 5½ yds. this will bring the number of poles; then poles divided by — are furlongs, and furlongs divided by — are miles; by going through with the operation, you will get 11 miles, 2 fur. 12 poles.

CLOTH MEASURE.

EXAMPLES FOR ILLUSTRATION.

1. In 16 yards, how many quarters and nails? Ans. 64 qrs. 256 na.

Yards.
16
4
——
64 qrs.
4
——
256 na.

Yards multiplied by 4 are quarters, quarters multiplied by 4 are nails; accordingly, I multiplied by 4, the quarters in a yard, and then that product by 4, the nails in a quarter; which produced the answer.

2. In 256 nails, how many yards? Ans. 16 yds.

Nails.
4 | 256
——
4 | 64 qrs.
——
16 yds.

Here I divided first by 4, the number of nails in a quarter of a yard, and then again by 4, the quarters in a yard, which brought 16 yards the answer.

EXAMPLES.

3. In 398 nails, how many yards? Ans. 24 yds. 3 qrs. 2 na.

Nails divided by — are qrs. quarters divided by — are yds.

4. In 24 yds. 3 qrs. 2 na. how many nails? Ans. 398 na.

Yards multiplied by — are qrs. &c. add in the qrs. and nails.

5. How many yards are there in 12 bales of cloth, each bale containing 20 pieces, and each piece 30 yards? 7200 yds.

Multiply the number of bales by the number of pieces in each bale, then —— the number of pieces by the number of yards in a piece.

6. In 15 pieces of muslin, each containing 21 yds. how many nails? Ans. 5040 nails.

Find the number of yards in 15 pieces; then yards multiplied by —
ters multiplied by — are nails.

Ells English how many nails? Ans. 520 na.

ultiplied by — are qrs. quarters multiplied by — are na.

8. In 324 nails how many Ells Flemish? Ans. 27 ells.

Nails divided by — are qrs. qrs. divided by — are Ells Flemish.

9. How many pair of pantaloons can be cut out of a piece of cloth containing 51¾ yards, if it takes 2¼ yds. to make a pair? Ans. 23 pair.

Reduce both number of yds. into qrs. and —— by the qrs. in a pair.

LAND or SQUARE MEASURE.

EXAMPLES FOR ILLUSTRATION.

1. In 25 A. 1R. 8P. how many roods and perches? Ans. 4048 perches.

A. R. P.
25 1 8
4
101
40
4048

I multiplied by 4, the roods in an acre, adding in the 1 rood, this produced 101 roods; I then multiplied by 40, the poles in a rood, adding in the 8 poles or perches, this produced 4048 poles the answer.

2. In 4048 perches, how many acres? Ans. 25A. 1R. 8P.

Perches.
4|0 | 404|8
4 | 101 8
25 1 8
A. R. P.

Here I divided by 40, the poles in a rood; this brought 101 roods, and 8 perches over; I then divided by 4, the roods in an acre, which brought 25 acres, 1 rood, to which I annexed the 8 perches; the whole together was the answer.

3. In 17 acres, how many perches? Ans. 2720 perches.

Acres multiplied by — are roods; roods multiplied by — are perches. Note, a rod, pole, or perch, is the same.

4. In 2720 perches, how many acres? Ans. 17 acres.

Perches divided by — are roods; roods divided by — are acres.

5. Suppose you have a field that contains 8A. 1R. 21P. and you divide it by running a fence across, taking off 3A. 3R. 24P. how many perches are left in the field? Ans. 717 perches.

Subtract the 3A. 3R. 24P. from the 8A. 1R. 21P. and bring the remainder into perches, like the first example.

6. Suppose there are three fields: the first contains 1591 perches, the second 1164, and the third 975 perches, how many acres are in the whole? Ans. 23A. 1R. 10P.

Add the content of the three fields into one sum, and bring the amount into acres. Perches divided by — are roods, &c.

7. In three tracts of undivided land, containing as follows: the first 14A. 3R. 21P. the second 19A. 1R. 29P. the third 23A. 2R. 20P. how many shares, of 90 perches each, are there in the whole? Ans. 103 shar

Add the content of each tract into one sum, and reduce the number of acres, &c. these contain into perches; acres multiplied by — are roods, roods multiplied by — are perches; then divide by the number of perches in a share, the quotient will be the answer.

LIQUID MEASURE.

EXAMPLES FOR ILLUSTRATION.

1. In 4 tuns of wine, how many Hds. gals. and qts?

Ans. 16Hbds. 1008 gals. 4032qts.

```
Tuns.
 4
 4
----
16 Hhds.
63
----
 48
96
----
1008 gals.
   4
----
4032 qts.
```

To find the answer to this question, I multiplied by 4, the Hhds. in a tun; this produced 16 Hhds. and to get the Hhds. into gals. I multiplied by 63, the gallons in a hogshead; this produced 1008 gallons; lastly, I multiplied by 4, the quarts in a gallon, which brought 4032 qts. the answer.

2. In 4032 quarts of wine, how many tuns? Ans. 4 tuns.

```
  4)4032
    ----
63)1008(4)16
   63      --
   ---      4 Tuns.
   378
   378
   ---
```

Here you will see, that I divided by 4; why? because 4 quarts make a gallon; then I divided by 63, the gals. in a hogshead, and then by 4, the hogsheads in a tun, which brought 4 tuns the answer.

EXAMPLES.

3. In 13 hogsheads, 19 gallons, 3 quarts of wine, how many quarts? Ans. 3355 qts.

Hhds. of wine multiplied by — are gals. gals. multiplied by — are quarts.

4. In 56384 pints of wine, how many hogsheads?

Ans. 111Hhds. 55gals.

Pints divided by — are quarts; quarts divided by — are gallons: gallons divided by — are hogsheads.

5. [illegible] barrels of cider, each 32 gallons, how many quarts?

Ans. 1536 qts.

of gallons, then gals. multiplied by —— are qts.

6. In 6195 pints of wine, how many tuns?

Ans. 3T. 0hhds. 18gal. 1qt. 1pt.

Pints divided by —— are qts. quarts divided by —— are gals. gallons divided by —— are hhds. hogsheads divided by —— are tuns.

7. Suppose you have 7 barrels of excellent cider, each containing 32 gallons, which you wish to draw off into bottles: the size of the bottles to be half gallons, quarts and pints, and to have an equal number of each; be so good as to find the number of bottles. Ans. 256 bottles of each kind.

Reduce the barrels to pints; find how many pints will fill a bottle of each kind; then —— the pints in the barrel by the pints in the bottles.

The barrels to be reduced to pints, because the bottles must be put down in pints, as there are pint bottles to be filled.

8. In 5 hogsheads of beer, each 54 gallons, how many 10 gallon and 5 gallon kegs, each an equal number?

Ans. 18 of each kind.

Divide the gals. in the 5hhds. by the number of gals. it takes to fill a keg of each kind.

DRY MEASURE.

EXAMPLES FOR ILLUSTRATION.

1. In 26Ch. 18bu. 2pks. how many pecks? Ans. 3818pks.

Ch. bu. pks.
26 18 2
36
——
164
79
——
954 bushels.
4
——
3818 pecks.

Here you will see, that I multiplied by 36, the bushels in a chaldron, and added in the 18 bushels; I then multiplied by 4, the pecks in a bushel, and added in the 2 pecks; this produced 3818 pecks, the answer.

2. In 3818 pecks, how many chaldrons?

Ans. 26Ch. 18bu. 2pks.

```
                 Ch.  bu. pks.
4)3818(36)954(26  18  2
  36       72
  ——       ——
   21      234
   20      216
  ——       ——
   18      18 bushels.
   16
  ——
  2 pecks.
```

I have divided by 4, because 4 pecks make a bushel; this brought 954bu. and 2pks. remainder; I then divided by 36, the bushels in a chaldron; this brought 26 chaldrons and 18 bushels remainder; the whole brought, 26Ch. 18bu. 2pks.

EXAMPLES.

3. In 4582 pints, how many bushels? Ans. 71bu. [illegible]pks. 3qts.

Pints divided by — are quarts; quarts divided by — are pecks; pecks divided by — are bushels.

4. In 14 bushels of corn, how many quarts? Ans. 448qts.

Bushels multiplied by — are pecks; pecks multiplied by — are qts.

5. In 6548 pecks, how many chaldron? Ans. 45ch. 17bu.

Pecks divided by — are bushels; bushels divided by — are chaldrons

6. In a cask of flaxseed, that contains 224 quarts, how many bushels? Ans. 7bu.

Quarts divided by — are pecks, &c.

7. Suppose you had 12 sacks of corn, each holding 4½ bushels, how many quarts do they contain? Ans. 1728qts.

Find the number of bushels in the sacks; and then, bushels multiplied by — are pecks; pecks multiplied by — are quarts.

8. Suppose you purchase 630 bushels of beans, how many barrels each holding 3½ bushels, will it take to hold the whole? Ans. 180

Reduce both numbers of bushels into half bushels; and then —— by the half bushels in a barrel.

SOLID MEASURE.

EXAMPLES FOR ILLUSTRATION.

1. In 12 tons of round timber, how many solid inches? Ans. 829440in.

Tons.
12
40
———
480
1728
———
3840
960
3360
480
———
829440
———

If you ask the reason, why I multiplied by 40, I answer: because 40 feet of round timber make a ton. Again, why I multiplied by 1728: because 1728 solid inches make a solid foot; this produced the number of inches in 12 tons.

2. In 829440 solid inches, how many tons of round timber? Ans. 12 tons

1728)829440(4|0)48(0
6912 —
12 tons.

I divided by 1728, the solid inches in a foot; in the next place, by 40, the number of feet in a ton of round timber; the last quotient was the tons required.

EXAMPLES.

3. In 8 tons of hewn timber, how many solid inches?
Ans. 691200 solid in.

Tons of hewn timber multiplied by — are feet; feet multiplied by — are inches.

4. In 7 cords of wood, how many solid feet and inches?
Ans. 896 feet 1548288 solid inches.

Cords multiplied by — are feet; feet multiplied by — are inches.

5. In 896 solid inches, how many cords? Ans. 7 cords.

Feet divided by — are cords.

TIME.

You will find Time very useful; therefore, pay attention to it.

EXAMPLES FOR ILLUSTRATION.

1. In 21 weeks, how many days, hours, minutes and seconds?
Ans. 147D. 3528hrs. 211680m. 12700800sec.

W.
21
7
147 D.
24
588
294
3528 hrs.
60
211680 m.
60
12700800 s.

I first multiplied by 7, the days in a week; then by 24, the hours in a day; then by 60, the minutes in an hour; and lastly, by 60, the seconds in a minute; which brought 12700800 seconds, the answer.

2. In 12700800 seconds, how many weeks?
Ans. 21 weeks.

6|0)1270080|0
6|0)21168|0
24)3528(7)147
24
112
96
168
168
21 W.

I found the answer to this question by dividing by 60, 60, 24 and 7. The reason why I divided by these figures, was, because 60 seconds make a minute; 60 minutes make an hour; 24 hours make a day; and 7 days make a week.

824692 A

EXAMPLES.

3. In 5D. 19hrs. 21m. 42sec. how many seconds?
Ans. 501702sec.

Days multiplied by — are hours, &c. Examine the Table. As you multiply, add in the hours, minutes and seconds.

4. In 2834962 seconds, how many weeks?
Ans. 8w. 0d. 19hrs. 29m. 22sec.

Seconds divided by — are minutes, &c.

5. How many days are there in 21 years, allowing a year to contain 365 days, 6 hours? Ans. 7670 days, 6 hours.

As 6 hours make ¼ of a day, multiply the number of years by 365¼, as taught, p. 60. If there be a remainder, when dividing by 4, bring it into hours by 24; and divide by the 4 again, to get the hours.

6. How many seconds in your age, when 14 years and 21 days old, allowing the year to contain 365 days?
Ans. 443318400 seconds.

When you —— by the 365, see that you add in the 21 days. Then, days multiplied by — are hours; hours multiplied by — are minutes; minutes multiplied by — are seconds.

7. How many days, since the birth of our Saviour to Christmas, 1831, allowing the year to contain 365¼ days?
Ans. 668772 days 18 hours.

Performed like the 5th example.

8. How many days, from June 6th to December 12th, (inclusive?)
Ans. 190 days.

June	25 days.
July	
August	
September	
October	
November	
December	12 days
	——
	190

Write down the months under each other, in the order they come, from June to December, with the number of days belonging to each, except the first and last. For June, reckon how many days are gone on the 6th, and deduct the number from the days in that month. For December, place the day of the month, the time is to be reckoned; place the months in the margin. As June contains 30 days, I deducted 5 from that number, for the days gone on the 6th [illegible]. For December, I placed the number mentioned, viz. 12. Add the whole together.

Note.—When the day the time is commenced, is not included, then its [illegible] of the month [illegible] from the days of that month.

9. How many days are there between the 21st day of August, [illegible], and the [illegible] day of May, [illegible]? Ans. [illegible] days.

[illegible] months in order, from August to May; reckon how many [illegible] August, including the day mentioned, and place it at the [illegible]. Then the days that belong to each month as they [illegible], place the number mentioned.

10. How many years, months and days, are there between the 10th of May, 1827, and the 19th of January, 1831?

Ans. 3yrs. 8mo. 9 days.

You may set down the years, months and days, last mentioned; and place the years, months, and days first mentioned, under them; the 19th of January, 1831, will stand thus: 1831y. 0m. 19d.; and the other you must find yourself; the time is reckoned from January to the beginning of the year.

11. Suppose a man should begin to work with a farmer on the 21st day of April, and should work till the 29th day of October, how many days is he entitled to receive pay for?

Ans. 192 days.

Performed like the 9th ex. The day he commenced is included.

CIRCULAR MOTION.

EXAMPLE FOR ILLUSTRATION.

1. In 5 signs, 16deg. 31min. 19sec. how many seconds?

```
S.   °   '   ''
5   16  31  19
30
———
166 deg.
 60
————
9991 m.
  60
——————
599479 sec.
```

In the table, I found that signs multiplied by 30, are degrees, because 30 degrees make a sign; degrees multiplied by 60, are minutes, because 60 minutes make a degree; minutes multiplied by 60, are seconds, because 60 seconds make a minute. I multiplied by the above numbers, adding in the degrees, minutes and seconds in their proper places.

2. In 599479 seconds, how many degrees, &c.?

Ans. 5s. 16deg. 31min. 19sec.

Seconds divided by — are minutes; minutes divided by — are deg. degrees divided by — are signs.

Questions for Exercise in Reduction.

1. In 37428 half pence, how many pounds?

Ans. 77£. 19s. 6d.

—— by the half pence in a penny; then, pence divided by — are shillings, &c.

2. In 12340 mills, how many half eagles?

Ans. 2 half E. 2 dolls. 34cts.

Bring the mills into dollars; and the dollars into half eagles.

3. In 120 dollars, how many mills? Ans. 120000 mills.

4. In 6£ 4s. 3d. 3qrs. how many farthings? Ans. 5967far.

See *the Table. It says,* pounds multiplied by 20 are shillings, &c.

5. How many tea-spoons, each 11 pennyweights, can be made out of 2lb. 6oz. 5dwts. of silver? Ans. 55

Divide the pennyweights in the given quantity by the dwt. in a spoon.

6. Suppose you had 3 tons of pig iron, how many pots could be cast from that quantity, allowing 12lb. for each pot? A. 560

Reduce the tons to pounds. Tons multiplied by — are C, &c. then ——— by the weight of a pot.

7. Suppose the distance between two places be 135 roods, and a person travel that distance 4 times each day, for the space of a year, (sundays excepted,) how many miles has he travelled at the end of the year? Ans. 528m. 1f. 2p.

Deduct the sundays in a year from 365; then ——— the rods travelled each day, by the number of days found; the product will be the whole number of rods or poles; then, poles divided by — are furlongs; furlongs divided by — are miles.

8. If a man have a farm containing 28392 rods of ground, and he give it to his three sons, how many acres will be the share of each? Ans. 59A. 0R. 24P.

To find the number of rods in a share ——— the whole number of rods by the number of shares; then, rods or poles divided by — are furlongs; furlongs divided by — are roods, &c.

9. If a man purchase 15 bales of linen, each bale containing 12 pieces, and each piece 22 yards, how many garments will the whole make, allowing 2yds. 3qrs. to a garment? Ans. 1440

Find the number of yards in the 15 bales; see 5th ex. Cloth Measure; bring the whole number of yards into quarters; then, divide by the quarters it takes to make a garment.

10. How many 3pt bottles will 2 hhds. of wine fill? A. 336

Divide the pints in a hogshead by the pints in a bottle.

11. If a vessel have on board 49 chaldrons of a coal, how many cart loads will there be, each 14 bushels? Ans. 126 loads.

You must ——— the bushels in 49 chaldrons by the bushels in a load.

12. In 1152 feet of bark, how many cords? Ans. 9 cords.

Feet multiplied by — are cords.

13. If a vessel leave one port on the 15th of May, and arrive at another on the 31st day of August, how many days passage had she? Ans. 108 days.

Examine the 8th example, in Time.

REDUCTION OF CURRENCIES.

The following Table shows the value of the Federal Dollar in the currencies of the different States, together with the currencies of Canada, Nova Scotia, England, and Ireland.

New Hampshire* Massachusetts Rhode Island Connecticut Virginia Kentucky and Tennessee Reckon 6s. or 72d. to the dollar.	New-York and North Carolina 8s. or 96 pence.	South Carolina and Georgia 4s. 8d. or 56 pence.
	New-Jersey Pennsylvania Delaware and Maryland 7s. 6d. or 90 pence.	Canada and Nova Scotia 5s. or 60 pence.
		England 4s. 6d. or 54 pence.
		Ireland 4s.10½d.or 58½ pence.

To reduce or change the currencies of the different States into Federal Money.

GENERAL RULE.

Reduce the currency into the lowest name, or denomination mentioned, either in the sum given to be changed, or in the value of a dollar, of the State or Country mentioned; then divide by as many of that name, or denomination, as make the dollar.

NOTE.—If there be a remainder after division, it must be multiplied by the cents in a dollar, and divided again as before; the quotient will be the cents. If there still be a remainder, multiply it by the mills in a cent, and divide again; this will bring the mills.

---

* The first four, viz. New Hampshire, Massachusetts, Rhode Island and Connecticut, including Maine and Vermont, are called New England States.

EXAMPLE FOR ILLUSTRATION.

1. Change 61£. 15s. 1d. New-York currency, into Federal money. Ans. 154D. 38cts. 5m. 40 rem.

```
 s.       £.  s.  d.
 8        61  15  1
12        20
---       ----
96        1235
            12
          -----
    96)14821(154$
       96
       ---
        522
        480
        ---
         421
         384
         ---
          37
          100
          ---
     96)3700(38 cts.
         288
         ---
          820
          768
          ---
           52
           10
           ---
       96)520(5 mills
          480
          ---
           40
           ---
```

By examining, I found that the lowest name mentioned, either in the currency given, or the value of the dollar, was pence; accordingly, I reduced the given sum to pence; then reduced the shillings, reckoned to a dollar, into pence, and divided by 96, the pence in a dollar; this brought 154 dollars and 37 remainder; the remainder, (as directed in the note,) I multiplied by 100, the cents in a dollar, and divided again; this brought 38 cents and 52 remainder; this I multiplied by 10, the mills in a cent, and divided as before; here the quotient was 5 mills and 40 remainder. The result of the operation showed that in 61£. 15s. 1d. there was 154 dollars, 38 cents, 5 mills and 40 rem.

EXAMPLES.

2. Change 48£. 12s. Connecticut currency* into Federal money. Ans. $162.

Reduce the given sum to shillings, then —— by the shillings in a Connecticut currency. By the table, you may see that 6 shillings koned to a dollar in that State.

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* this question been given in New Hampshire, Massachusetts, land, Virginia, Kentucky, or Tennessee currency, the operation have been the same as in this example.

3. Change 125£. 6s. 9d. Connecticut currency into dollars.
Ans. 417D. 79cts. 1m. 48 rem.

Reduce the given sum to pence? Why? Because the lowest name mentioned is pence. Reduce the shillings in a dollar N. E. currency to pence, and ——. If there be a remainder, multiply it by the cents in a dollar, and divide again, and so on.

4. Change 96£. 7s. North Carolina currency* into dollars.
Ans. 240D. 87cts. 5m.

Reduce the sum to shillings, and divide by the dollar; N. C. currency.

5. Change 42£. 19s. 5d. 3qrs. New Jersey currency, into dollars. Ans. 114 D. 59cts. 7m. 80 rem.

Reduce the given sum into qrs. remember pounds multiplied by — are shillings, &c. reduce the dollar New Jersey currency into qrs. and divide. Had this question been given in Pennsylvania, Delaware, or Maryland currency, the operation would have been the same.

6. Change 99£. 19s. 5d. South Carolina and Georgia currency into dollars. Ans. 428D. 44cts. 6m. 24 rem.

Reduce the given sum and the dollar both to pence, and divide.

7. Change 195£. 6s. Canada and Nova Scotia currency, into Federal money. Ans. 781D. 20cts.

The table shows how much is reckoned to the dollar, you need only to reduce the given sum to shillings, then divide, &c.

8. Change 100£. English, or Sterling money, into dollars.
Ans. 444D. 44cts. 4m. 24 rem.

The given sum and the dollar must both be reduced to pence, as there are pence mentioned in the dollar; proceed as before.

9. Change 22£. 17s. 4½d. Irish money into dollars.
Ans. 93D. 82cts. 6 rem.

You must —— the half pence in the given sum, by the half pence in a dollar Irish, &c.

To change Federal Money into the currencies of the different States.

GENERAL RULE.

Multiply the cents in the given sum, by the pence in a dollar, and cut off two figures from the right towards the left; the figures to the left of the point will be the pence in the currency sought, which bring into pounds by dividing by the pence in a shilling, and the shillings in a pound; the quotient will be the pounds, &c. required.

Note 1. When the given sum consists of dollars, cents and mills, multiply the mills in the whole sum by the pence in a dollar; cut off 3 figures and divide as directed in the rule.

2. If there be half pence in the amount of a dollar, then multiply by the half pence in the dollar; the product will be half pence, which bring into pounds by the rules of Reduction

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* *For New York* currency, the operation would have been the sa

3. If there be a remainder, cut off, (when you multiply the en sum by the pence in a dollar,) multiply that remainder 4, the farthings in a penny; and if the given sum was cents, r reduced to cents,) divide by 100; but if to mills; divide by 000,* and the quotient will be the farthings, to said question.

EXAMPLES FOR ILLUSTRATION.

1. Change 75 dollars 53 cents, into New York currency.
Ans. 30£. 4s. 2d.

D. cts.
75 . 53
100
7553
96
45318
67977
12)7250|88
20)60(4 2
30 4 2
£. s. d.

I brought the sum into cents, and multiplied by 96, the pence in a dollar, New York currency; and then cut off two figures as directed; this brought the pence, and to get them into pounds, I divided by 12, the pence in a shilling, and by 20 the shillings in a pound. Had the figures cut off (viz. 88,) been multiplied by 4; the farthings in a penny, and divided by 100, the result would have been 3 quarters and 52 remainder, making the answer, 30£. 4s. 2¾d. and 52 remainder.

2. Change 65 dolls. 28cts. 5m. into Connecticut currency.
Ans. 19£. 11s. 8d. 2qr. 80 rem.

mills.
65285
72
130570
456995
12)4700|520 520
4
20)39(1 8
20.80
19 11 8
£. s. d.

There being mills in the question, I wrote down the whole in mills, at once and multiplied by the pence in a dollar, Connecticut currency; then (according to note 1,) I cut off 3 figures and divided by 12, the pence in a shilling, and 20, the shillings in a pound; the 520 remainder, I multiplied by 4, and divided by 1000; that is, I pointed off 3 figures, which was the same; thi brought 2 quarters and 80 remainde

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* *Or, what* will be the same for the 100, point off 2 figures, or for t *1000, three figures* from right to left.

Observe.—These two examples might have been multiplied by the shillings in a dollar, and cut off as directed; then, the figures to the left divided by 20, the shillings in a pound, would have brought the pounds and shillings; the remainder, multiplied by 12, and divided as directed, would have brought the pence, and that remainder, by 4, and divided again, the farthings. But the general rule, perhaps, will be best for the learner, as the mind is less perplexed by following one particular method; for, when the dollar is not even shillings, the general rule must be followed.

3. Change 325D. 62cts. into Connecticut currency.*

Ans. 97£. 13s. 8d. and 64 rem.

Connecticut currency is 6s. or 72d. to the dollar, multiply the cents in the given sum by it, and proceed as directed in the rule.

If the remainder, (64,) had been multiplied by 4, and two figures pointed off, it would have brought 2qrs. and 56 remainder.

Had this question been given to be brought into New Hampshire, Massachusetts, Rhode Island, Virginia, Kentucky, or Tennessee currency, the operation would have been the same.

4. Change 149D. 36 cts. into New York currency.

Ans. 59£. 14s. 10d. 2qr. 24 rem.

——— by the pence or shillings in a dollar, New York currency, and proceed according to rule. The operation would have been the same for North Carolina.

5. Change 94D. 29cts. into New Jersey currency.

Ans. 35£. 7s. 2d. 10 rem.

Find the pence in a dollar New Jersey currency and proceed. Pennsylvania, Delaware, and Maryland would have been the same.

6. Change 128D. 94cts. into South Carolina, and Georgia currency. Ans. 30£. 1s. 8d. 2qr. 56 rem.

7. Change 245 dolls. 61 cts. into Canada, or Nova Scotia currency. Ans. 61£. 8s. 0d. 2qr. 40 rem.

You will find that —— pence are a dollar in the above currencies.

8. Change 300 dolls. 50cts. into English, or Sterling money.

Ans. 67£. 12s. 3d.

9. Change 129 dollars 49 cents into Irish money.

Ans. 31£. 11s. 3d. 33 rem.

See Note 2. Multiply the cents in the given sum, by the half pence in the dollar; bring the half pence into pounds.

Questions for Exercise, in Reduction of Currencies.

1. Change 38£. 7s. 9d. Massachusetts currency, into dollars.

Ans. 127D. 95cts. 8m. 24 rem.

Attend to the rule, tables, &c. find the pence in a dollar Massachusetts currency, and proceed.

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* In all the States where the dollar is an even number of shillings, the *learner may proceed* according to the general rule, or the observ *given after the examples* for illustration.

2. Change 195 dollars 40 cts. into Massachusetts currency.
Ans. 58£. 12s. 4d. 3qr. 20 rem.

3. Change 249 dolls. 33 cts. into New York currency.
Ans. 99£. 14s. 7d. 2qrs. 72 rem.

4. Change 21£. 7s. 4d. Pennsylvania currency into Federal money. Ans. 56D. 97cts. 7m. 70 rem.

5. Change 160 dolls. 40 cts. into Georgia currency.
Ans. 37£. 8s. 6d. 1qr. 60 rem.

6. Change 430 dolls. 21 cts. into Canada currency.
Ans. 107£. 11s. 0d. 2qrs. 40 rem.

7. Change 19£ 17s. 4d. English or Sterling money into dollars. Ans. 88D. 29cts. 6m. 16 rem.

8. Change 49£. 14s. 5d. Irish money into dollars.
Ans. 203D. 98cts. 2m. 106 rem.

Reduce the sum to half pence, likewise the dollar into ———.

9. Change 16£. 18s. 4d. North Carolina currency into dollars. Ans. 42D. 29cts. 1m. 64 rem.

THE SINGLE RULE OF THREE DIRECT.

The learner has now passed through the rules necessary for an introduction to the Rule of Three. I hope he has been attentive, and thereby prepared to enter this useful rule.

THE RULE OF THREE DIRECT

Teacheth, by having three numbers given to find a fourth in such proportion to the third, as the second is to the first; for this reason, it is termed the rule of proportion, but most generally the rule of three, from its having three numbers given. It is sometimes called the golden rule, owing to its great and extensive usefulness in arithmetic.

As you proceed, endeavour to understand every part of the rule. Pay strict attention, it will save you much trouble.

Observe 1. Of the three numbers, or terms given, two of them are of the same name or kind, and one of these must be the first number, or term in stating, and the other the third; the remaining number, which is the second term in stating, is always of the same name or kind with the answer or thing sought.

2. The first and second terms are a supposition, the last a

RULE FOR STATING THE QUESTION.

1. Place the number which you want to find the value of, for the third term.

2. Place the one which is of the same name or kind of the third, for the first term.

3. Place the remaining one, which is of the same name or kind with the answer, for the second term.

If there be a difficulty in determining which the first and third terms are, it may be removed by reading the question, and finding which term is the demand, or the one you want to find the value of; for this must be the third term, and the other of the same name or kind, the first;* consequently, the other, or remaining one, which is of the same kind with the answer, must be the second.†

Note.—When the first or third term, or both, consist of different names or denominations, (which is often the case,) they must be reduced to the lowest denomination mentioned in either. That is, if the first term is pence, the third term must be pence likewise. If the third term be ounces, the first term must be ounces. If the second term be of different names or denominations it must be reduced to the lowest mentioned. After the statement is thus prepared, proceed by the following

Rule for Working the Question.

1. Multiply the second and third terms together, and divide the product by the first term. The quotient will be the answer to the question in the same name or denomination the second term was left in. This you must remember; for, by it, you can determine what name the answer has; and this answer may be brought into any denomination required.

2. If there be a remainder, after dividing by the first term. reduce it to the next denomination below the last quotient, and divide by the same divisor again; the quotient of this will be so many of the name you reduced it into. In this manner proceed, till you get the lowest, or least name required; and the different quotients will be the answer. Or, if the answer comes in a small name, as farthings, mills, ounces, &c. they can be

---

* When the third term is money, the first must be money; when it is weight, the first must be weight; when it is measure, the first must be measure.

† When the *answer is money,* the second term must be money; when *it is weight or measure,* the second term must be weight or measure

brought into the denomination required, by dividing, as taught in Reduction.

PROOF.

Change the order of the question, making the third term the first, and the answer the second, &c.

Note. The Rule of Three consists of two kinds: the Rule of Three Direct, and the Rule of Three Inverse.

THE RULE OF THREE DIRECT

Is, when *more* requires *more*, or *less* requires *less*. More requires more, is when the third term is greater than the first, and requires the fourth term, or answer, to be greater than the second; and less requires less, is when the third term is less than the first, and requires the fourth term, or answer, to be less than the second.

THE RULE OF THREE INVERSE

Is, when *more* requires *less*, or *less* requires *more*. More requires less, is when the third term is greater than the first, and requires the fourth term or answer to be less than the second; and less requires more, is when the third term is less than the first, and requires the fourth term, or answer, to be less than the second.

Observe.—There are some methods of operation in direct proportion, when they can be used, perform the work in a shorter manner than the general rule, which are as follows :

1. Divide the second term by the first, multiply the quotient by the third term, and the product will be the answer.
2. Divide the third term by the first, multiply the quotient into the second, and the product will be the answer.
3. Divide the first term by the second, and the third term by that quotient, and the last quotient will be the answer.
4. Divide the first term by the third, and the second by that quotient, and the last quotient will be the answer.

The following is another method of stating The Single Rule of Three. It will apply to both Direct and Inverse proportion.

Read from the commencement of the Single Rule of Three, to Obs. 1. as what is there given will apply to this method.

RULE FOR STATING THE QUESTION.

1. Place that number or term in the third place, which is of the same name or kind with the answer, or thing sought.

2. Then examine, and see whether, from the nature of the *question*, the answer is to be more than the third term. If re, *place* the greater of the two remaining terms in the

cond place, and the less one in the first place; if the answer be less than the third term, then place the less one for the second term, and the greater for the first.

When the first, or second term, or both, consist of differen denominations, (which is often the case,) they must be reduced to the lowest name or denomination mentioned in either; that is, if the first term be pence, the second term must be pence likewise; If the second term be ounces, the first term must be ounces; the third term, if of different names or denominations, must be reduced to the lowest name mentioned. After the question is thus prepared, proceed by the following

RULE FOR WORKING THE QUESTION.

1. As in the former method, multiply the second and third terms together, and divide that product by the first; the quotient will be the answer to the question in the same name or denomination you left the third term in; remember this; for, by it, you can determine what name your answer has, and this answer may be brought into any denomination required.

2. If there be a remainder after dividing by the first term, reduce it to the next denomination below the last quotient, and divide by the same divisor again; the quotient of this will be so many of the name you reduced it into; in this manner proceed till you get the lowest or least name required, and the different quotients will be the answer; or, if the answer comes in a small name, as farthings, mills, ounces, &c. you can bring them into the denomination required by dividing as taught in Reduction.

EXAMPLES FOR ILLUSTRATION.

1. If 1lb. of butter cost 1s. 9d. what cost 39lbs?

Ans. 3£. 8s. 3d.

```
1 Term.  2 Term.  3 Term.
  lb.     s.  d.    lb.
If 1  :   1   9  ::  39
         12
        ----
         21
         39
        ----
        189
        63
        ----
      1|819
       |---
     12|819
       |---
    2|0| 6|8  3
       |---
        3  8  3
        £. s. d.
```

It will be for the benefit of the learner to examine every part with care and attention.

Stated by the first rule. You will perceive that, in this question, two of the terms are of the same name; these I placed one for the first, and the other for the third terms, minding to place the demanding term, (or the one the question required the value of,) in the third place, and the other, being one of the supposition, in the first place, (that is, for the first term,) and the remaining one, (which was of the same kind with the answer,) for the second. Having stated the question, I proceeded, according to rule, to examine the first and third terms, and found that they were of the same name, and neither of them of different denominations. I next examined the second term, which I found to consist of more than one denomination; this, as directed, I reduced to the lowest name mentioned, which was pence; after I had reduced this to pence, I,(according to rule,) multiplied the second and third terms together, and divided the product by the first term. (Here observe, that when either of the terms consists of an unit, you may omit to multiply or divide by it, as the question will stand the same.) In this example I divided by 1, the first term, and it brought 819, the same figures I had before I divided; which shows that I might have omitted dividing by it. Now the question arose, what is the name of this quotient 819; the rule tells me that, whatever name the second term is left in, the quotient or fourth term will come in the same name; by examining, I found that my second term was left in pence; consequently, my fourth term is pence; which according to the rules of Reduction, I brought into pounds, by dividing by 12, the [illegible] ng, and 20, the shillings in a pound; this brought [illegible] swer.

2. If 39lbs. of butter cost 3£. 8s. 3d. what cost 1lb?

Ans. 1s. 9d.

```
lbs.    £.  s.  d.    lb.
39   :  3   8   3  ::  1
       20
      ----
       68
       12
      ----
   39)819(12)21
      78    ----
     ----     1   9
      39      s.  d.
      39
      --
```

Here I proceeded according to rule, placing the demanding term in the third place, and the other of the same kind, in the first, and the remaining one in the second. By examining the first and third terms, I found that they were alike in name, but the second, I found to consist of pounds shillings and pence; and, as the lowest name was pence, I reduced this term to pence. The next to be done was, to multiply the second and third terms together; but the third term being one, I omitted multiplying by it, as it would not have altered the question; I now proceeded to divide by the first term 39, this brought 21. Now what was the name of this quotient? the second term was reduced to pence; then this according to rule, is pence, which I brought into shillings; the result was 1s. 9d. the answer which proves the last example.

The same question as above, stated by rule 2d.

2. If 39lbs. of butter cost 3£. 8s. 3d. what cost 1lb?

Ans. 1s. 9d.

```
lbs.  lb.     £.  s.  d.
39  : 1  ::   3   8   3
             20
             --
             68
             12
             --
          39)819(12)21
             78    --
            ----     1  9
             39      s. d.
             39
            ----
```

I began, placing that term in the third place, which is of the same kind with the answer. I then considered whether, from the nature of the question, the answer must be more or less than the third term, which I found to be less; according to rule, I placed the 39lbs. the greater of the two, for the first term, and the other for the second. By examining the first and second terms, I found that they were alike in name; but the third, I found to consist of pounds, shillings, and pence; and, as the lowest name was pence, I reduced this term to pence. The next to be done was to multiply the second and third terms together; but, the second term being one, I omitted it, as it would not alter the question. I now proceeded to divide by the first term 39; this brought 21, (as in t last example,) which I brought into shillings by dividing by 12, the pence in a shilling, the result was 1s. 9d. the answer.

3. Suppose 14lbs. of sugar cost 1D. 75cts. what cost 2C. 1qr. 19lbs. at that rate? Ans. 33D. 87cts. 5m.

```
1 Term.     2 Term.         3 Term.
  lbs.      D.  cts.      C. qr. lb.
   14   :   1 . 75   : :  2   1  19
            100           4
            ---          --
            175           9
                         28
                        ---
                        271
                        175
                       ----
                       1355
                      1897
                      271
                      -----   D.   cts.   m.
                   14)47425(  33 .  87 .  5
                      42
                      --
                       54
                       42
                      ---
                       122
                       112
                       ---
                        105
                         98
                        ---
                          7
                          10
                          --
                      14)70(5 mills.
                          70
                          --
```

In this question, the two terms that are of a kind are the 14lbs. and the 2C. 1qr. 19lbs. and as the C. &c. is the demanding term, or the one the question required the value of, I placed that for d the 14lbs. for the first, and the price for ng stated the question, I examined the first and third terms, and found that the third consisted of different denominations; and as pounds were the lowest mentioned, I reduced it to pounds by the rules of reduction; this brought the third term to the same name or denomination of the first; I now proceeded to examine the second term, and found this to consist of two denominations, viz. dollars and cents; I reduced this term to cents, multiplying by 100, the cents in a dollar; then, according to the rule, I multiplied my second and third terms together, and divided that product by the first term, (the 14lbs.) this brought 3387. Here the question arose, what is the name of this quotient? By observing my second term, I perceived that I had reduced that to cents; consequently, my quotient, or fourth term, is cents; this I brought into dollars, by pointing off two figures from right to left for cents, (as heretofore taught,) after having done this, I observed that I had 7 remainder, after dividing. Here was another question; what must be done with this? The rule is the guide; it says, if there happens to be a remainder, &c. reduce it to the next denomination, below the last quotient, and divide by the same divisor again, &c. The quotient was cents and mills, being the next denomination below; I reduced the remainder to mills, and divided again by the divisor 14; this brought 5 mills, which I placed to the right of the quotient, which was the answer, viz. 33D. 87cts. 5m.

The last question stated by rule 2.

3. Suppose 14lbs. of sugar cost 1D. 75cts. what cost 2C. 1qr. 19lbs. at that rate? Ans. 33D. 87cts. 5 m.

1 Term.		2 Term.				3 Term.
lbs.		C. qr. lb.				D. cts.
14	:	2	1	19	: :	1 . 75
		4				100
		9				175
		28				
		271				
		175				
		1355				
		1897				
		271				

$. cts. m.
14)47425(33 . 87 . 5
42
— &c.

To state this question by rule 2, I placed that term in the third place which was of the same kind with the answer, viz. $1.75cts. Then, as I found, from the nature of the question, that the answer must be more than the third term, accordingly I placed the greater of the two, for the second term. After having stated the question, I examined my first and second terms, and found that the second consisted of different denominations, and as pounds were the lowest mentioned. I reduced this term to pounds by the rules of reduction; this brought the second term to the same name or denomination of the first; I now proceeded to examine the third term, and found it to consist of two denominations, viz. dollars and cents; this I reduced to cents, multiplying by 100, the cents in a dollar; then, according to rule, I multiplied my second and third terms together, and divided that product by the first term, (the 14lb.)

NOTE.—After multiplying the second and third terms together, the same observations apply to this question that were given in the last.

4. Suppose you purchase 3C. 2qr. 14lbs. of lead for 13£. 10s. 8d. what is 1lb. 8oz. worth at that rate? Ans. 1 shilling.

```
        1 Term.              2 Term.            3 Term.
  C.   qrs.   lbs.       £.    s.    d.        lb.   oz.
  3     2      14   :    13    10    8    ::    1     8
  4                      20                    16
 ---                    ----                   ---
 14                     270                    24
 28                      12
 ---                    ----
 126                    3248
 28                       24
 ----                   -----
 406                    12992
  16                    6496
 ----                   -----
 2436              6496)77952(12)12
 406                    6496     --
 ----                   -----        1 s.
 6496                   12992
 ----                   12992
                        -----
```

mining the question, I perceived that the 1lb. 8oz. was ding term; this I placed for the third term, and the other term of the same kind, for the first, viz. the C. qrs. and lbs. and the remaining one for the second; having stated the question as in the margin, I proceeded to examine the first and third terms, and found that the third term was of two names, and lower than the first; this I reduced to its lowest name, viz. ounces, by multiplying by 16, the ounces in a pound. I, then, reduced the first term to the same name with the third, multiplying it by 4, the quarters in a cwt. 28, the lbs. in a qr. and 16, the ounces in a lb. minding to add in the quarters and pounds in their proper places; after having done this, I examined the second term, which I found to consist of different denominations, and as pence was the lowest name mentioned, I reduced this term to pence, by multiplying by 20, the shillings in a pound; and 12, the pence in a shilling, adding in the shilling and pence. This being done, I multiplied my second and third terms together, and divided the product by the first; the result was 12; this quotient was pence; because the second term was left in pence; this I divided by 12, the pence in a shilling, which brought one shilling, the answer; it being the value of 1lb. 8oz.

Note.—The following questions are stated by rule 1, and the instructions given apply to that method. But those who prefer working by the 2d rule, can do it by changing the order of the second and third terms when stated; and reading second for third, and third for second, in the instruction.

EXAMPLES.

5. If 1lb. of sugar cost 11cts. what cost 49lbs. at that rate?
Ans. 5 dolls. 39cts.

	1 Term.		2 Term.		3 Term.
	lb.		cts.		lbs.
Stated thus; as	1	:	11	::	49

The terms in this question being, each of them, of but one denomination, they will not have to be reduced any lower than they now stand; and to find the answer, multiply the second and third terms together and divide that product by the first; the first term being an unit, or one, the learner may omit dividing by it, as the quotient would be the same; remember, that the answer will come in the same name with the second term, which bring into dollars, as before taught.

6. If 7lbs. of rice cost 30cts. what will 1C. 3qrs. 12lbs. cost?
Ans. 8D. 91cts. 4m. 2rem.

	1 Term.		2 Term.		3 Term.
	lbs.		cts.		C. qr. lb.
Stated thus;	7	:	30	::	1 3 12

[illegible] different de[illegible]

[illegible]

Ans. 111 [illegible]

[illegible] proceed w[illegible]

[illegible]

Ans. $12 [illegible]

[illegible]

Ans. 112£.

[illegible]

[illegible] pieces, each so [illegible] of pieces, [illegible] brings the first [illegible] Reduce the second term to the lowest name [illegible] before.

11. If 1 lb. of [illegible] cost $2 40 cts. what cost 1 cwt.

Ans. $ 268.8

lb. $. cts. Cwt.
Stated thus, 1 : 2 . 40 :: 1

Reduce the 3d term into pounds, then the 1st. and 3d. will be a
reduce the 2d term to the lowest name mentioned, &c.

12. How many cwt. of coffee can I buy for 43£ 12s. 8d
1s. 2d. per pound?

Ans. 6C. 2qrs. 2

s. d. lb. £ s. d.
thus; 1 2 : 1 :: 43 12 8

g the lowest name mentioned in both first and third te
y must be reduced to pence; then go on, the quotient
because the second term is pounds; pounds divided
&c.

13. If 1 pair of boots cost $4.75cts. what will 21 pair cost?
Ans. $99.75cts.

pr. D.cts. pr.
Stated thus; 1 : 4 75 :: 21

14. If a captain of a vessel sells a cargo of ashes for 10½cts. per bushel, and he delivers 85 cart loads, each 14 bushels, how much does the whole come to? Ans. $124.95cts.

B s lds B
Stated thus; 1 : 10½ :: 85 each 14

Multiply the number of loads by the number of bushels in a load; this will produce the number of bushels; proceed.

15. If you buy 340 bushels of rye, at 4s. 2d. per bushel, how many dollars, New-York currency, will it come to?
Ans. 177D. 08cts. 3m. 32 rem.

B. s. d. B.
Stated thus; 1 : 4 2 :: 340

The answer to this question will come in pence, which divide by the pence in a dollar, New-York currency; this will bring 177 dolls. and 8 remainder; multiply this by the cents in a dollar, and divide again; this will bring 8cts. and 32 rem. then, multiply by the mills in a cent, and divide as before; the result will be 3 mills, and 32 remainder: the whole will be the answer required.

16. If 1 pint of wine cost 14 cents, what will 1 hogshead come to, at that rate? Ans. 70D. 56cts.

pt. cts. hhd.
Stated thus; 1 : 14 :: 1

Reduce the hogsheads to pints, and go on; observe the rule.

17. If currant wine be sold at 45 dolls. the barrel, containing 31½ gallons, what is it worth per pint? Ans. 17cts. 8m. 144rem.

gal. D. pt.
Stated thus; 31½ : 45 :: 1

Reduce the gallons to pints; see that you add in the ½ gallon as 2 quarts; reduce the dollars to cents, and proceed.

18. If a person purchasing linen, has cash about him to the amount of $17.29cts. how many yards can he buy for that sum, if he gives 38cts. per yard? Ans. 45yds. 2qrs.

cts. yd. D. cts.
Stated thus; 38 : 1 :: 17 29

Reduce the third term to the same name of the first.

19. If 1 lb. of butter cost 15½ cents, what will 4 firkins, each weighing 62 lb. come to? Ans. $38.44cts.

lb. cts. fir. lb.
Stated thus; 1 : 15½ :: 4 each 62

Multiply the number of firkins and wt. of a firkin together, and the 1st and 3d terms will be alike. Reduce the 2d term to half cents, &c.

20. If 1 yard of muslin cost 29 cents, what will 31 yds. cost?
Ans. 8D

Try to state this yourself—the 31 yards is the demanding te

21. If 1 gallon of molasses cost 3s. 4d. what will 104 gallons come to? Ans. 17£ 6s. 8d.

You must try. Read the rule. The 3s. 4d. must be the 2d term.

22. If 104 gallons of molasses cost 17£. 6s, 8d. what is it per gallon? Ans. 3s. 4d.

This question proves the last; make the 104 gal. the first term; reduce the 17*l*. 6s. 8d. into pence, the lowest name mentioned, &c.

23. Suppose a man had worked for you, from the 11th of June till the 23d of August following, at 5s. 6d. per day, how much do you owe him? Ans. 20£. 7s.

First, find the number of days, as taught in Reduction; write down June 20, as he began to work in the morning of June 11, that day is reckoned; then, write down the number of days belonging to each month, till you get to August; for August, write down 23, add them together. Then, state the question, making the number of days the third term.

24. What will 6C. 3qrs. 12lb. of iron come to, at 5½d. per lb? Ans. 17£. 12s.

Keep the rule in mind: read what it says about the term you want to find the value of. In this question, the 6C., &c. is the demanding term, or the one the question requires the value of; place 1 lb. for the first term.

25. If 1 board cost 17½ cents, what will 469 cost? $82.07cts. 5m.

State the question; then reduce the cts. to half cts. and proceed on.

26. Suppose a merchant purchase at auction, 4 bales of muslin, each bale containing 25 pieces, and each piece 33yds. what does the whole come to, at 27½cts. per yard. Ans. 907D. 50cts.

yd. cts. B. pieces. yds.
Stated thus; 1 : 27½ :: 4 each 25 each 33

Multiply the number of bales by the number of pieces, and that product by the number of yards: the last product will be the number of yds. which is like the 1st term. Reduce the cents to half cents; the answer will come in half cents.

27. If 3 puncheons of rum, containing 102, 98, and 107 gallons, be sold for 5s. 6d. 2qr. per gallon, what is the amount of the whole? Ans. 85£. 1s. 3d. 2qrs.

Add the content of the puncheons into one sum: then state it, making the number of gallons the 3d term: reduce the 2d term into qrs.: the answer will come in qrs. which bring into pounds.

28. How many yards of broad cloth, at $3.48cts. per yard, can be purchased with $313.20cts. Ans. 90 yards.

The $313. 20cts. is the demanding term; the 3D. 48cts. the 1st term.

29. If you purchase 11 casks of fine salt, each containing 7 bushels, at 4s. 7d. per bushel, what does it come to? Ans. 17£. 12s. 11d.

The 11 casks, each 7 bushels, must be the third term. Reduce the second term to —— the lowest name mentioned.

30. If 1 pair of shoes cost 10s. 7d. how many dollars, at 8s. each, will buy 15 doz. pair? Ans. 238D. 12cts. 5m.

The 15 doz. pr. must be the 3d term. Reduce this to pairs by multiplying by the number in a dozen; the answer will come in pence. To get the dollars, divide by the pence in a dollar.

31. If a barrel of flour cost $7.50cts. what is that a pound? Ans. 3cts. 8m. 52 rem.

A barrel of flour contains 196lbs. This must be the first term, 1lb. is the demanding term.

32. If a silver smith sells a tea set, that weighs together 5lb. 1oz. 13pwts. 17grs. at 10s. 4d. per oz. how much does it come to? Ans. 31£. 17s. 4d. 3qrs. 464 rem.

oz. s. d. lbs. oz. pwts. grs.
Stated thus; 1 : 10 4 :: 5 1 13 17

The lowest name mentioned in the 3d term is grains; consequently, this must be reduced to grains. Pounds, multiplied by — are ounces, &c. The first term, being ounces, must be reduced to grains. Ounces multiplied by — are pennyweights, &c. Reduce the 2d term to ———.

33. What is pork per lb. that costs 17 dolls. per barrel? Ans. 8cts. 5m.

A barrel of pork is 200lbs. Make this the 1st. term, and 1lb. the 3d.

34. What is sugar per lb. that cost 13 dolls. per cwt? Ans. 11cts. 6m. 8 rem.

If at loss how to state this question, read the rule again.

35. If a man pays 3 dolls. 25cts. per week for board, what is that a year? Ans. 169 dolls.

52 weeks are a year, which make the third term.

36. Suppose you earn 4s. 9d. per day, what will a year's wages come to at that rate? Ans. 86£. 13s. 9d.

Reckon 365 days to the year, and make this the third term.

37. The salary of the President of the United States is $25000 a year, what is that an hour, reckoning 365d. 6hrs. to the year? Ans. $2.85cts. 1m. 8134 rem.

D. hrs. $ hr.
Stated thus; 365 6 : 25000 :: 1

Reduce the 1st term to hours.

38. If a man in debt compounds with his creditors for 13s. 9d. on the pound, how much must that man receive whose bill is 168£. 10s? Ans. 115£ 16s. 10½d.

£ s. d. £. s.
Stated : :: 168 10

Reduce the 1st. and 3d. terms to the same name, and the second to the lowest mentioned.

39. If a man earns $529.25cts. in a year, what is that per day? Ans. 1D. 45cts.

Reckon 365 days to the year, and make that the first term.

40. If a man drinks a gill of rum a day that costs 6cts. w
does it amount to in a year? Ans. $21.90

Say, as 1 day is to 6cts. so is 365 days, &c.

41. If you have a salary of 600 dollars a year, how m
may you spend each day, to lay up 162 dolls. at the years e
Ans. 1D. 20

Subtract the $162 from the 500; then state it, making the 365
the 1st term, and the remainder found as above, the 2d. &c.

42. Suppose you purchase 12 boxes of raisins, each cont
ing 25lb. at 18d. a pound; how many dollars, at 8s. each, do t
come to; and suppose, that at the time of bargaining, you
derstood the seller, that the price of the raisins was 18 c
per pound; what do they come to at the last mentioned pr
and what is the difference?

Ans. at 18 pence, they come to $56.2
at 18 cents, they come to 54.00
Difference, 2.25

Make two statements; first, find what the raisins come to at 18d. pe
making the 12 boxes, each 25lb. the 3d term. The answer will com
pence, which divide by the pence in a dollar; this will get the first
swer. Make the second statement like the first, only the 18cts. mu
the 2d. term; this answer will come in cents, which bring into dollars,

43. If flour be sold at 3s. 6d. the 14lb. what is it a barr
Ans. 2£.

The 14lb. must be the 1st term, and the pounds in a barrel the 3

44. If a stick, or staff, that is 5 feet long, give 8 feet 4 inc
shade on level ground, what is the height of a steeple, wh
shade is 220 feet? Ans. 132 f

Say, as the length of the shade of the staff is to its height; so is
length of the shade of the steeple, to its height.

45. Suppose the whole property of a Town liable to be
ed, amounts to 448246 dolls. 50cts. and there are 1250 dol
to be raised for the support of the poor; what must that
pay whose property is valued at 2500 dollars?
Ans. 6D. 97cts. 1m. 27364850 r

Stated thus; as $448246.50cts : $1250 :: 2500, work by rule.

46. Suppose a company of 13 gentlemen with their lad
have been upon an excursion of pleasure, and find, on their
turn, that their expenses have amounted to $29.28cts. what
each have to pay? Ans. $2.25cts. 2m. 4 r

Make the 13 gentlemen the first term.

47. If a vessel has a freight of wood on board, amoun
to 24 cords, and it is sold at 18s. 6d. the cart load, what
me to, allowing 2½ loads to the cord? Ans. 55£.

stating it, you may multiply the 24 cords by the 2½ loads;
the number of loads which make the 3d term.

48. If I pay 5£. 9s. 9½d. for the carriage of 9C. 1qr. 18lb. what is it per lb? Ans. 1¼d.

The 9C. &c. must be the first term; the terms must be reduced to the lowest name mentioned.

49. If 6lbs. of butter be worth 9lbs. of sugar, how many pounds of sugar is a firkin of butter containing 58½lbs. worth?
Ans. 87lbs. 12 oz. of sugar.

Attend to the rule; the 58½lbs. is the demanding term.

50. Suppose you carry to a merchant, hams to the amount of 6 dolls. 87cts. 5m. and you wish to get molasses at 39 cents per gallon in return, how many gallons must you have?
Ans. 17gal. 2qts. 200 rem.

The value of the hams must be the third term.

51. If a merchant purchase a puncheon of rum, containing 101 gallons, for 96 dollars, and by accident 12 gallons leak out; what does the remainder stand him in a gallon?
Ans. $1. 07cts. 8m. 58 rem.

Subtract the number of gallons leaked out from the whole number, and make this the first term.

52. Suppose a woollen manufacturer purchases 321lbs. of wool in the dirt, for 160D. 50cts. and after being washed and dried, finds that it has wasted one third, what does the remainder stand him in a pound? Ans. 75cts.

Subtract the ⅓ waste from the whole number of pounds, and make this the first term.

53. If a man had been at work 91 days, and received 20£. 9s. 6d. what did he receive a day? Ans. 4s. 6d.

Observe the rule; the 1 day is the demanding term.

54. If $100 gain $5 interest in a year, how much will $85 gain in the same time? Ans. 4.25cts.

55. If a man lays out $548.80cts. in tobacco, at 14cts. per lb. how many kegs had he, each weighing 56lbs? Ans. 70 kegs.

Make the $548.80cts. the third term; the answer will come in lbs. which divide by 56 to get the number of kegs.

56. How many dozen pair of gloves can I buy for $14.25cts. at 18¾ cents per pair? Ans. 6doz. and 4 pair.

Make the 18¾cts. the 1st. term; the 1st. and 3d. terms must be reduced to quarter cents. The answer will come in pairs, which divide by as many as make a dozen.

57. Wheat is generally sold by weight; this being the case, what will 1495lb. come to, at 14s. 5d. per bushel of 60lbs. each?
Ans. 17£. 19s. 2d. 2qr. 20 rem.

Say, as 60lbs. is to 14s. 5d. so is 1495lbs. &c. work by the rule.

58. If eggs be sold 8 for a shilling, what is 2948 eggs worth at that rate? Ans. 18£. 8s. 6d.

The *8 eggs must be* the first term.

59. If ashes falls short 2 quarts in a bushel when measured, how much loss will there be in 100 loads of 14 bushels each? Ans. 87½ bushels.

Say, as 1 bu. is to 2 qts. so is 100 loads, each 14 bu. &c. The answer will come in quarts, which bring into bushels.

60. Suppose the before mentioned ashes had been bought at 2 dolls. 12½cts. per load, of 14 bushels each, what does the loss amount to? Ans. 13D. 28cts. 1m. 7 rem.

See how many bushels loss there were in the last question, and make it the third term in this, and the 14 bushels the first term.

61. If 1lb. of white lead cost 11cts. 5m. what will 30 kegs, each 28lbs come to? Ans. 96D. 60cts.

Place the 30 kegs each 28lbs. for the third term.

62. If red lead be bought for 9 dollars per cwt. what must it be sold for per lb. to gain 2 dolls. 50cts. per cwt. Ans. 10cts. 2m. 76 rem.

Add the $2.50cts. to the 9 dolls. and place this sum for the second term; and 1 cwt. for the first.

63. Suppose you buy a cask of linseed oil, containing 60 gallons for $55.50cts. and, by accident, 13 gallons leaked out; what must you sell it for per gallon, to be no loser? Ans. $1. 18cts. 4 rem.

Subtract the 13 gallons from the 60, and make the remainder the first term.

64. If you purchase a piece of cloth, containing 21 yards, for 39£. 10s. and you cut off 4½ yds. for your own use; what must the remainder be sold for per yard, so that you get the first cost? Ans. 2£. 7s. 10d. 2qr. 6 rem.

Subtract the 4½ yards from the 21, and make the remainder the first term; the 1st. and 3d. terms must be reduced to half yds.

65. Suppose I have a piece of cloth containing 35 yds. and after selling it out at 4D·75cts per yd. find that I had received only 99D. 75cts. whereas, it ought to have brought $166.25cts. should I suspect that a part had been stolen, pray how many yards are missing? Ans. 14 yards.

This question can be stated more than one way, the following perhaps is the plainest; thus, as $4 75cts. : 1yd. :: $99.75cts. &c. This will show the number of yds. received, pay for which, deduct from the whole number; the remainder will be the number of yds. missing.

66. If a merchant ships 148C. 3qrs. 19lbs. of hemp, agreeing to pay 6½ cents per lb. freight, upon all delivered safe, but the vessel being wrecked, 21C. 2qrs. 19lb. was lost; how much must be paid freight for, and how much does it amount to?

Ans. He pays freight for 127C. 1qr. and it amounts to $926.38cts.

Subtract what was lost from the whole shipped, and make the remainder the third term, make the terms alike.

67. If a merchant buys 175lbs. of ginger, for which he gave 16£. but, it being damaged, he sold it for 12£. 8s. how much did he lose per lb? Ans. 4d. 3qrs. 131 rem.

Subtract the 12£. 8s. from the 16£. and make the remainder the 2d. term.

68. It has been stated, that, in the year 1810, there were 33365529 gallons of spirits left, to be consumed in the United States; after adding what was imported, and deducting what was exported; this being the case, how much must each person consume, allowing the population of the United States, to be 7230514 persons? Ans. 4gal. 2qts. 3312864 rem.

Make the number of persons the first term, the gallons the 2d.

69. The estimated amount of the national debt of England, in 1827, is said to have been 900000000£.; how long would it take to count this debt, supposing you counted 50 dollars per minute, and 12 hours a day, during the whole time? (Sundays excepted.) Ans. 354 years, 309 days, 1 hour, 20 min.

Reduce the given sum to Federal money; (see 9th example, Reduction of Currencies, 105th page;) then state it, making the amount found the 3d term; the 50 dolls. the 1st. and 1 min. the 2d. The answer will come in minutes, which bring into hours, by the rules of reduction; then, to get the days, divide by 12, the hours given to the day; to bring the years, deduct the Sundays in a year from 365, and divide the days found by the remainder.

70. Suppose a farmer had a cow, worth 10£. 7s. and one of his workmen had a mind to have her; but, not having the money, he was willing to work until he had earned her; how many days will he have to labour, at 4s. 6d. per day, to pay for the cow? Ans. 46 days.

Make the 4s. 6d. the first term, &c.

71. Suppose a vessel loaded with a cargo consisting of wheat, rye and corn, and it is sold in the following manner; 295 bushels of wheat, at 12s. 6d. per bushel; 594 bushels of rye, at 7s. 9d. per bushel; and 621 bushels of corn, at 7s. 3d. per bushel; how many dollars does the whole amount to, in New-York, New Jersey, and Connecticut currency?

Ans. The whole amounts to 1599D. 15cts. 6m. 24 rem. N.Y.
1705D. 76cts. 6m. 60 rem. N.J.
2132D. 20cts. 8m. 24 rem. Con.

Make a statement for each article, the number of bushels being the third term; the quotient of each statement will come in pence, which may be added into one sum, and then divided by the pence in a dollar; of each state, separately.

THE RULE OF THREE INVERSE.

For the difference between Direct and Inverse proportion, and for an explanation of the Rule of Three Inverse. (See Rule of Three Direct, page 110.)

The Rule of Three Inverse teacheth, by having three numbers or terms given, to find a fourth, which shall have the same proportion to the second, as the first has to the third.

Note. In Inverse Proportion, the greater the third term is, in respect to the first; the less will the fourth be in respect to the second; or, the less the third term is in proportion to the first, the greater the fourth must be in proportion to the second.

If there be a difficulty in distinguishing between Direct, and Indirect, or Inverse proportion, it may be removed by attentively considering the nature and tenor of the question proposed; for if thereby it appears, that when the third term of stating is less than the first, the answer must be greater than the second; then, the proportion is direct; for this will be less requiring less, and more requiring more.

But if the third term be less than the first, and yet the sense of the question requires the fourth to be greater than the second; or, if when the third term be greater than the first, the answer must be less than the second, the proportion is Inverse; for this will be less requiring more, and more requiring less.

FOR EXAMPLE.

If 4 men can cover a house in 12 days, how many days will it take 6 men to do the same work? Ans. 8 days.

men. days. men.
It may be stated thus, if 4 : 12 :: 6 This may be read as follows; if 4 men require 12 days, how much time will 6 men require. The answer is 8 days; here you will see, that more requires less; for the greater the number of men employed, the less time it will take to perform the work.

If 6 men can cover a house in 8 days, how many days will it take 4 men to do the same work? Ans. 12 days.

men. days. men.
Stated thus; If 6 : 8 :: 4 The answer is 12 days. Here less requires more; for the less the number of men, the more time is required; therefore it belongs to Inverse proportion; the last may be read thus, if 6 men require 8 days, how much time will 4 men require.

RULE.

S[illegible] reduce the terms as in the Rule of Three Direct;
e first and second terms together, and divide that
hird; the quotient will be the answer in the same

name or denomination that the second, or middle, term was left in.

Proof, as in Direct proportion.

EXAMPLE FOR ILLUSTRATION.

If 12 men build a boat in $24\frac{1}{2}$ days, in what time would 6 men do the same work? Ans. 49 days.

```
M.     D.     M.
12  :  24½  ::  6
        2
      ----
       49
       12
      ----
     6)588
      ----
     2)98
      ----
       49 days.
      ----
```

This statement may be read thus: If 12 men require $24\frac{1}{2}$ days, how much time will 6 men require? In this question, less requires more; for the 3d term is less than the 1st; and, according to the nature of the question, the 4th term must be greater than the 2d; for it is evident, that it will take a longer time for a less number of men to perform the work.

The 2d term in this question, having more than one denomination, I reduced it to the lowest name mentioned, viz. half days, and then multiplied the 1st and 2d terms together, and divided that product by the 3d; this brought 98 half days, (the 2d term being half days,) which I divided by 2, to bring them into days; the quotient was 49 days, the answer.

Read and examine the rule well, if you wish to understand it.

EXAMPLES.

2. If 3 men can reap a field of wheat in 15 days, how many men can do the same work in 3 days? Ans. 15 men.

	D.		M.		D.	
Stated thus;	15	:	3	::	3	Go according to rule.

3. If a traveller performs a journey in 10 days, when the day is 12 hours long, in how many days would he perform the same journey, when the day is but 8 hours long? Ans. 15 days

	H.		D.		H.
Stated thus;	12	:	10	::	8

4. Suppose you lend your friend 500 dollars for 3 months, he promising you the like kindness; but when you call upon him he can spare no more than 150 dollars; how long must you keep that sum, to make good the favour? Ans. 10 months.

Make the 500 dollars the first term.

5. If a board be $4\frac{1}{2}$ inches wide, how much in length will make a square foot? Ans. 32 inches.

	in br.		in le.		in br.
Stated thus;	12	:	12	::	$4\frac{1}{2}$

The first and third terms must be reduced to half inches.

6. How many yards of carpeting, that is 8 quarters of a wide, will it take to cover a floor that is 18 feet long and 14 feet wide? Ans. 37⅓yds.

Instead of placing 3 quarters for one of the terms, you may set down 27, the number of inches in 3 qrs, of a yd. which makes the statement thus; as 14 feet wide : 18 feet long : 27 in. wide, &c. You will see that the 3d term is inches, and the 1st term feet; the first term, then, must be reduced to inches, and proceed. The answer will come in feet, which divide by the feet in a yard.

7. If, when flour is 9 dollars per barrel, the loaf weighs 32 ounces, what must the loaf weigh, when flour is 6 dollars? Ans. 48 ounces.

Make the 9 dollars the first term.

8. If 100 dollars, in 12 months, gain 6 dollars interest, what principal will gain the same sum in 8 months? Ans. 150 dolls.

State it, making the 12 mo. the 1st term, and the 8 mo. the 3d.

9. If, for 3 dollars, I have 2cwt of goods carried 80 miles, how far can I have 10cwt. carried for the same money? Ans. 16m.

Place 80 miles for the 2d term, and 10C. for the 3d.

10. If a piece of ground be 20 rods wide, how long must it be to make an acre? Ans. 8 rods.

Say, as 1 rod wide is to 160 rods long, so is 20 rods wide, &c.

11. Suppose a garrison, consisting of 1000 men, have provision for 3 months, and it becomes necessary that they should hold the station 8 months, how many men must depart, that the same provision may serve that time. Ans. 625 men.

The 3 months must be the first term. By the statement, you will find how many may continue in the garrison; subtract this quotient from the number in the garrison, and the remainder will show how many must depart.

12. Suppose, that for a company of artillery, consisting of 85 men, it takes 170 yards of cloth, that is 5 quarters wide, to make each a coat; how many yards of shalloon, that is 3 quarters wide, will be sufficient to line them? Ans. 283⅓ yards.

Make the 5 quarters the first term, and the 170 yds. the second, &c.

* * *

PRACTICE.

Practice is so termed from its general use to all persons concerned in trade and business.

All questions in the Rule of Three Direct, when the first term is an unit or 1, may be performed by this rule. It is useful when money is reckoned in pounds, shillings and pence; and is performed by taking and dividing by the aliquot, or even part, or [illegible] nny, shilling, pound, &c.

T [illegible] useless in reckoning Federal money; [illegible] [illegible] ith ease by Multiplication.

Proof.—This rule may be proved by the Rule of Three Direct, Compound Multiplication, or by varying the order of the question.

Before you proceed to work the questions in this rule, it will be well to learn the following table perfectly.

PRATICE TABLE.

Parts of a Shil.		Parts of a Pound.				Parts of Cwt.	
d	s	s. d.	£	s. d.	£	lb.	Cwt.
6 is	$\frac{1}{2}$	10 0 is	$\frac{1}{2}$	1 4 is	$\frac{1}{15}$	56 is	$\frac{1}{2}$
4	$\frac{1}{3}$	6 8	$\frac{1}{3}$	1 3	$\frac{1}{16}$	28	$\frac{1}{4}$
3	$\frac{1}{4}$	5 0	$\frac{1}{4}$	1 0	$\frac{1}{20}$	16	$\frac{1}{7}$
2	$\frac{1}{6}$	4 0	$\frac{1}{5}$	0 8	$\frac{1}{30}$	14	$\frac{1}{8}$
$1\frac{1}{2}$	$\frac{1}{8}$	3 4	$\frac{1}{6}$	0 6	$\frac{1}{40}$	8	$\frac{1}{14}$
1	$\frac{1}{12}$	2 6	$\frac{1}{8}$	0 4	$\frac{1}{60}$	7	$\frac{1}{16}$
		2 0	$\frac{1}{10}$	0 3	$\frac{1}{80}$		
		1 8	$\frac{1}{12}$	0 2	$\frac{1}{120}$		

The different parts of this rule are explained under each case.

CASE I.

When the given price is less than a penny.

RULE.

Divide by the aliquot, or even parts there are in a penny, and then divide by 12, the pence in a shilling; and by 20, the shillings in a pound; the last will bring the answer.

EXAMPLE FOR ILLUSTRATION.

1. What will 3240 lemons come to, at ¼d. a piece?

Ans. 3£ 7s. 6d.

```
¼ | ¼  |3240
  |    |----
  | 12 | 810
  |    |----
  |2|0 | 6|7  6
  |    |----------
  |    |  3   7   6
          £   s.  d.
```

I placed the 3240 as you see; then drew three lines, and proceeded to take the parts; in this question, there is but little difficulty, as a farthing is the aliquot or even part of a penny. In this I said, ¼ is the ¼ (fourth) of a penny; and then, divided by the under figure, the 4 next to the question; this produced 810 pence; then, according to rule, I divided by 12, the pence in a shilling, and 20, the shillings in a pound.

FURTHER ILLUSTRATION.

In this question, I supposed 3240 lemons, at 1 penny a piece, to be 3240 pence; then, certainly, if the price be only 1 farthing, and a farthing the fourth part of a penny, the fourth part of the 3240 pence will be the number *of pence required*; which brought into pounds, as directed, will *bring the answer.*

EXAMPLES.

2. What will 1941 pencils come to, at ½ pence each?

Ans. 4£ 0s. 10½d.

½ | ½ | 1941

Divide by the 2 in the right hand column; here you will have 1 remainder; this is 1 penny, (as the 1941 is supposed to be pence,) which must be brought into farthings; saying, once 4, the farthings in a penny, is 4; then 2 into 4, twice; this brings 2 quarters, or a half penny; then divide by 12, the pence in a shilling, and 20, the shillings in a pound. You will see, that if 1941 pencils, at 1 penny each, be 1941 pence, if reckoned at ½ penny each, they will come to half that number of pence.

2. What will 2461lbs. come to, at ¾d. per lb.?

Ans. 7£ 13s. 9¾d.

½ | ½ | 2461
¼ | ½ |

As the price in this question is not the aliquot, or even parts of a penny, it requires two operations, as in the margin. I said in the first place, that ½ is the ½ of a penny; then ¼ is the ½ of a ½d.; I might have taken both parts from the penny, saying, ½d. is the ½ of a penny, and ¼ is the ¼ of a penny; then, the given number must have been divided by both parts; but to proceed with the parts taken, you must divide the given number by the upper 2 in the right hand column; then divide that quotient by the other 2 in the same column, add the quotients together, and divide as before. Observe, when dividing by the upper 2, there will be 1 penny remainder, which bring into farthings, and divide by the 2 again; when dividing by the under 2, remember you must divide the ½ penny, or 2qrs. in the last quotient, by it.

CASE II.

When the price is less than a shilling.

RULE.

Take the aliquot, or even part of a shilling, and divide as before; the quotient will be the answer in shillings, which divided by 20, the shillings in a pound, will give the pounds. In case the given price is not the aliquot, or even part of a shilling; then, take parts for the greatest even part in the price, and the remaining part of the price may be taken from the part or parts already taken; these quotients, added together, will be the answer in shillings, which bring into pounds, as directed.

FURTHER EXPLANATION OF THE RULE.

Suppose you had 8¾d given for price.

6 | ½
2 | ⅓

In this price 6d. is the greatest even part; so I said 6 pence is the ½ (half) of a shilling; there is 2¾d. remaining; and as 2d. is an even part of 6d. I said 2d. is the ⅓ (third) of 6 pence, there is still ¾ left; the even part of 2d. I took the ½d. first, saying, ½d. of 2 pence; and lastly, there is ¼ remaining; for ½ (half) of a ½ penny.

EXAMPLE FOR ILLUSTRATION.

1. What will 2395 sheets of paper come to, at 1d. a sheet?

Ans. 9£ 19s. 7d.

$$\begin{array}{|c|c|l}
 & & \text{s.} \\
1 & \frac{1}{12} & 2395 \\
\cline{3-3}
 & 2|0 & \;19|9\;\;7 \\
\hline
\multicolumn{3}{r}{9\;\;19\;\;7} \\
\multicolumn{3}{r}{\text{£}\;\;\text{s.}\;\;\text{d.}}
\end{array}$$

Here I considered that 2395 sheets of paper, at 1 shilling per sheet, would be 2395 shillings; now it is evident, that, at 1 penny a sheet, it must be the twelfth part of that number; accordingly, I said 1d. is the $\frac{1}{12}$ (twelfth) of a shilling; when dividing, I had 7 over, which being 7 shillings, I brought them into pence; saying, 7 times 12 are 84; then, 12, the divisor, into 84, seven times; this brought 7 pence; by dividing, I got 199s. 7d.; the shillings I divided by 20, as directed; the result was 9£ 19s. 7d. the answer.

2. What will 2963lbs. come to, at 1d. per lb.?

Ans. 12£ 6s. 11d.

$$\begin{array}{|c|c|l}
 & & \text{s.} \\
1 & \frac{1}{12} & 2963 \\
\cline{3-3}
\end{array}$$

Proceed on, as in the last example.

3. What will 4929 lbs. come to, at $1\frac{1}{4}$d. per lb.

Ans. 25£ 13s. $5\frac{1}{4}$d.

$$\begin{array}{|c|c|l}
 & & \text{s.} \\
1 & \frac{1}{12} & 4929 \\
\cline{3-3}
\frac{1}{4} & \frac{1}{4} &
\end{array}$$

Observe. The price, viz. $1\frac{1}{4}$d. is not the aliquot or even part of a shilling; so I said 1 penny is the $\frac{1}{12}$ of a shilling, and $\frac{1}{4}$ is the $\frac{1}{4}$ (fourth) of a penny; after dividing, add the two quotients together, and divide as before.

4. What will 649 yards come to, at $1\frac{1}{2}$d. per yard?

Ans. 4£ 1s. $1\frac{1}{2}$d.

$$\begin{array}{|c|c|l}
 & & \text{s.} \\
1\frac{1}{2} & \frac{1}{8} & 649 \\
\cline{3-3}
 & &
\end{array}$$

By the table you will see that $1\frac{1}{2}$d. is the $\frac{1}{8}$ of a shilling. When dividing by 8, there will be 1 shilling remainder; this must be brought into pence, saying, once 12 are 12; then 8 into 12 once and 4 pence over; the 4 pence must be brought into farthings; saying, 4 times 4 are 16, eight into 16 twice; this produces 2qrs. or a half penny; go on as directed.

5. What will 2462 inches come to, at $1\frac{3}{4}$ per inch?

Ans. 17£ 19s. $0\frac{1}{2}$d.

$$\begin{array}{|c|c|l}
1\frac{1}{2} & \frac{1}{8} & 2462 \\
\cline{3-3}
\frac{1}{4} & \frac{1}{6} &
\end{array}$$

NOTE.—When dividing by 8, there will be 6 shillings remainder, which bring into pence, and divide again; when dividing by 6, there will be 1 shilling remainder; this must be brought into pence, and added to the pence in the quotient above, and divided by the 6; with the 1 shilling over, say, once 12 are 12; and 9, (the pence in the quotient above,) are 21, then, 6 into 21, three *times and 3* over; this remainder is three pence, *to be brought into farthings*, saying, 3 times 4 are 12; six into 12 twice *which brings $\frac{1}{2}$ penny*; go on to divide and add as directed.

6. 5382 yards, at 2d. per yard? Ans. 44£ 17s.

Place it as before, and say, 2 is the $\frac{1}{6}$ of a shilling.

7. 2949 yds. of ribbon, at $2\frac{1}{4}$d. per yd. Ans. 27£ 12s. $11\frac{1}{4}$d.

Take Parts for 2d as before, saying, 2d is the $\frac{1}{6}$ of a shilling; and for the $\frac{1}{4}$. you may know what part it is, by asking yourself the question, how many farthings are there in 2d.? the answer is 8; then $\frac{1}{4}$ is the $\frac{1}{8}$ of 2d.

8. 3694 Jew's harps, at $2\frac{1}{2}$ each. Ans. 38£ 9s. 7d.

After taking parts for the 2d as before, for the $\frac{1}{2}$d. observe the directions in the last example; viz. ask yourself how many half pence there are in 2d. which will shew the part required.

9. 254 lb. of whiting, at $2\frac{3}{4}$ per lb.? Ans. 2*l*. 18s. $2\frac{1}{2}$d.

Take parts for the $2\frac{1}{2}$d. then say, $\frac{1}{4}$ is the half of a half penny.

10. 1000lbs. of ochre, at 3d. per lb. Ans. 12£ 10s.

You will see by the table, that 3d is the —— of a shilling.

11. $260\frac{1}{2}$lbs. of rice, at $3\frac{1}{4}$d. per lb. Ans. 3*l*. 10s. $6\frac{1}{2}$d.

For the $260\frac{1}{2}$lbs. place 260s. 6d. and divide by the parts.

After taking parts for the 3d, find what part of the 3d. one farthing is; and place it accordingly.

12. 100 yards of binding, at $3\frac{1}{2}$ per yard. Ans. 1*l*. 9s. 2d.

Take parts for 3d, as before, then a half penny is the —— of 3d.

13. 375lbs. of lead, at $3\frac{3}{4}$d per lb. Ans. 5 . 17s $2\frac{1}{4}$d.

Take parts for $3\frac{1}{2}$d as before, then say $\frac{1}{4}$ is the —— of a half penny.

14. 196lbs. of flour, at 4d. per lb. Ans. 3*l*. 5s. 4d.

Remember the table; 4d. is the —— of a shilling.

15. 696lbs. of Spanish brown, at $4\frac{1}{4}$d. per lb. Ans. 12*l*. 6s. 6d.

4	$\frac{1}{3}$	696
		——
$\frac{1}{4}$	$\frac{1}{16}$	

3	$\frac{1}{4}$	696
		——
1	$\frac{1}{3}$	
$\frac{1}{4}$	$\frac{1}{4}$	

I have here given two methods of taking parts, for $4\frac{1}{4}$d. the right hand method is taken, that the work may be easier; for, in the left hand method, I said, $\frac{1}{4}$ is the $\frac{1}{16}$, and dividing by 16 is more difficult for the learner than dividing by the figures in the right hand method.

16. 164 pencils at $4\frac{1}{2}$d. each. Ans. 3*l*. 1s. 6d.

Say 4d. is the —— of a shilling; then a half penny is $\frac{1}{8}$ of 4d.

12. 264 tumblers, at $4\frac{3}{4}$ each. Ans. 5*l*. 4s. 6d.

Take parts for $4\frac{1}{2}$d. as in the last example; then say, $\frac{1}{4}$ is the — of a $\frac{1}{2}$d.

18. 365lbs. of cheese, at 5d. per lb. Ans. 7*l*. 12s. 1d.

Say 4d. is the —— of a shilling; then 1d. is the —— of 4d.

19. $300\frac{1}{4}$lbs. of iron, at $5\frac{1}{4}$d. per lb. Ans. 6*l*. 11s. $4\frac{1}{4}$d.

For the $300\frac{1}{4}$ lb. place 300s. 3d. and proceed to take parts for 5d saying 4d. is the —— of a shilling; 1d. is the —— of 4d. then $\frac{1}{4}$ is the —— of a penny.

20. 492 quarts of cider, at $5\frac{1}{2}$d. per quart. Ans. 11*l*. 5s. 6d.

Try to take the parts for $5\frac{1}{2}$d. yourself.

21. 95 melons, at $5\frac{3}{4}$d. each. Ans. 2*l*. 5s. $6\frac{1}{4}$d.

lbs. of beef, at 6d. per lb. Ans. 7*l*. 7s.

the —— of a shilling. It must appear very plain, that

294lbs. at 1 shilling per lb. be 294 shillings. If reckoned at 6d. it must be half that number of shillings, because 6d. is the half of a shilling.

23. 191 oranges at 6¼d each. Ans. 4£. 19s. 5¾d.

6	$\frac{1}{2}$	191
$\frac{1}{4}$	$\frac{1}{24}$	

Here again, I have given two methods of taking parts; the right hand method, will be the easiest; for, by the left hand method you would have to divide by 24, which makes the process more difficult.

4	$\frac{1}{3}$	191
2	$\frac{1}{2}$	
$\frac{1}{4}$	$\frac{1}{8}$	

24. 391¾lbs of fish, at 6½d per lb. Ans. 10£. 12s. 2¼d.

Say, 6d. is the —— of a shilling; and a ½d. is the —— of 6 pence.

Observe, for the 391¾lb. place 391s. 9d.

25. 200lbs. of pork, at 6¾d. per lb. Ans. 5£. 12s. 6d.

Take the parts for 6d. as in the last example; then say, ½ is the —— of 6d. ¼ is the —— of a half penny.

26. 295lbs. of sugar, at 7d. per lb. Ans. 8£. 12s. 1d.

6d. is the greatest even part of a shilling; for the remainder, 1d. say, 1d. is the —— of 6d.

27. 169lbs. of lard, at 7¼d. per lb. Ans. 5£. 2s. 1¼d.

Here exercise your judgment.

28. 195 pint mugs, at 7½d. a piece. Ans. 6£. 1s. 10½d.

29. 349 rails, at 7¾d. a piece. Ans. 11£. 5s. 4¾d.

Say, 6d. is the —— of a shilling; 1d. is the —— of 6d.; ½ is the —— of a 1d. and ¼ is the —— of ½d.

30. 264 shad, at 8d. a piece. Ans. 8£. 16s.

Take the parts for 6d. first; then say, 2d. is the —— of 6 pence.

31. 296 quarts of beer, at 8¼ per quart. Ans. 10£. 3s. 6d.

After taking parts as in the last ex. say ¼ is the —— of 2 pence.

32. 148 boxes, at 8½d. each. Ans. 5£. 4s. 10d.

33. 416lbs. of ham, at 8¾d. per lb. Ans. 15£. 3s. 4d.

Take parts for 8½d. as before; then, ¼ is the —— of a ½d.

34. 89 panes of glass, at 9d. a pane. Ans. 3£. 6s. 9d.

6d. is the greatest even part; then say, 3d. is the —— of 6 pence.

35. 449lbs. of nails, at 9¼d. per lb. Ans. 17£. 6s. 1¼d.

36. 175lbs. of raisins, at 9½d. per lb. Ans. 6£. 18s. 6½d.

37. 729 yards of muslin, at 9¾d. per yard. Ans. 29*l*. 12s. 3¾d.

Say, 6d. is the —— of a shilling; 3d. is the —— of 6d; ½d. is the —— of 3d. ¼d. is the —— of ½d.

38. 521lbs. of honey, at 10d. per lb. Ans. 21*l*. 14s. 2d.

When the price is 10d. you can annex a cipher to the given number, and divide by 12, and 20, to get the answer; but to do it by taking parts, proceed as in the margin.

6	$\frac{1}{2}$	521
4	$\frac{1}{3}$	

If parts be taken according to the left hand method; the given number, must be divided by both divisors; but, by the right hand method, the work will be as before.

6	$\frac{1}{2}$	521
3	$\frac{1}{2}$	
1	$\frac{1}{3}$	

39. 379 yards of tow cloth, at 10¼d. per yard. Ans. 16*l.* 3s. 8¾d.

You may take parts for 10d. according to the right hand method, in the last example; then say, ¼ is the —— of 1 penny.

40. 39lbs. of litherage, at 10½d. per lb. Ans. 1*l.* 14s. 1½d.

41. 219 boards, at 10¾d. a piece. Ans. 9*l.* 16s. 2¼d.

6d. is the —— of a shilling; 3d. is the —— of 6d.; 1d. is the —— of 3d.; ½d. is the —— of 1d.; and ¼d. is the —— of a ½d.

42. 37lbs. of butter, at 11d. per lb. Ans. 1*l.* 13s. 11d.

```
6|1/2|37
 |   |——
4|1/3|
1|1/4|
```

To find the answer to this question, take parts as in the margin, and divde the top, or shilling line, by the first two divisors; because both the parts were taken from the shilling; divide by the last divisor as before.

43. 260lbs. nails, at 11¼d. per lb. Ans. 12*l.* 3s. 9d.

For 11d. take parts, and divide as before; then say, ¼d. is the —— of 1d.

44. 69lbs. of figs, at 11½d. per lb. Ans. 3*l.* 6s. 1½d.

The 11d. as before; try to take the rest yourself.

45. 168 books, at 11¾d. a piece. Ans. 8*l.* 4s. 6d.

6d. is the —— of a shilling; 4d. is the —— of a shilling; 1d. is the —— of 4 pence; ½d. is the —— of a penny; ¼d. is the —— of ½d.

CASE III.

When the price is more than a shilling, but less than two.

RULE.

Take the part, or parts, for so much of the given price as is more than a shilling, as in the last rule; that is, if the price be 15¾d. take the parts of 3¾d. only; and let the given quantity stand for shillings, which add with the rest, their sum will be the answer in shillings; which divide by 20, the shillings in a pound.

EXAMPLES FOR ILLUSTRATION.

1. 495 brushes, at 1s. 3¼d. each. Ans. 31*l.* 9s. 0¾d.

```
          s.
3  |1/4 |495
   |    |123   9
1/4|1/12| 10   3¾
        |————————
  2|0   |62(9  0¾
         ——
         31 9  0¾
```

According to the rule, I took parts for what the price was, more than a shilling; that is, for 3¼d.; the parts for the 3¼d. I took, as in the last case; after dividing, I added the whole together, and divided the sum by 20.

To understand this operation, attend to what follows. In this question, there are 495lbs which, at 1s. per lb. are 495 shillings; and then for the 3d. the fourth of that sum is taken; because 3d. is the fourth of a shilling and, lastly, the twelfth of the last quotient is taken; because 1 farthing is the twelfth of 3d. the sum of these was the answer in shillings.

Note.—The parts of all the prices between 13d. and 23d. are taken, the same as in the last case or rule; thus, for 19d. take parts for 7d. because 19d. is 7d. more than a shilling, &c. For 12¼d. 12½d. and 12¾d. take parts of the price more than 1 shilling, as in case 1st.

2. 249 yards of holland, at 12¼d. per yard.
Ans. 12*l*. 14s. 2¼d.

| ¼ | ¼ | 249
——
12 | 62 ¼
——
5 2¼
——
2 | 0 | 25(4 2¼
——
12 14 2¼
£. s. d.

In this question, I took parts for the price over 1 shilling, as in case 1st. which, being ¼d. I said, ¼d. is the ¼ of a penny; this brought 62¼d. which, being divided by 12; brought 5s. 2¼d.; these I added to 249, the shillings considered in the given price, and divided the amount by 20, the shillings in a pound.

EXAMPLES.

3. 621 knives, at 12½d a piece. Ans. 32*l*. 6s. 10½d.

621
——

Say, ½ is the —— of a penny. Remember to add the shillings brought, by dividing by 2, and 12, to the upper line, or given number.

4. 263 chickens, at 12¾d. each. Ans. 13*l*. 19s. 5¼d.

Proceed with the ½d. as in the last example; then say, ¼d. is the —— of a half penny. After dividing by both divisors, add the quotients together, divide by 12; and add the shillings brought, to the 263, or upper number, &c.

5. 68½lbs. of white lead, at 13d. or 1s. 1d. per lb.
Ans. 3*l*. 14s. 2½d.

s. d.
| 1 | 1/12 | 68 6
5 8½
——

Take parts for all the price over a shilling, viz. 1d. add the quotient brought, by dividing by 12, to the given number, the sum will be the answer in shillings. Here, observe, that 68½lbs. at 1s. per lb. is 68 shillings and 6d. and 68½lbs. at 1d. per lb. are 68½ pence or 5 shillings and 8½ pence, the sum of which must be the value of 68½lbs. at 13d.

6. 299 pair of hinges, at 13¼d. per pair.
Ans. 16*l*. 10s. 1¾d.

Take parts for all the price over a shilling, (which in this ex. is 1¼d.) the same as in the last case. Say, 1d. is the —— of a shilling; and ¼d. is the —— of a penny.

1[illegible] [illegible] of lamp black, at 1s. 5½d. per lb. Ans. 7*l.* 4s. 4½d.

[illegible] take parts, for 5½d.; 4d. is the —— of a shilling [illegible] pence; ½d. is the —— of a penny.

[illegible] bran, at 19¾d. per bushel. Ans. 7*l.* 16s. 4¼d.

[illegible] 19¾d. exceed 12d.; and take parts accordingly. 6d. [illegible] shilling, &c.

[illegible] of muslin, at 22½d. per yard. Ans. 33*l.* 11s. 3d.

[illegible] for 10½d. as at 10½d. in the last case, and proceed.

[illegible] bushels of potatoes, at 1s. 11¾d. per bushel. Ans. 19*l.* 5s. 11¼d.

[illegible] is the —— of a shilling, &c. taken as at 11¾d. in the last [illegible]

CASE IV.

When the price consists of any even number of shillings under 20.

RULE.

Multiply the given quantity by half the given price, and double the first figure of the product for shillings; and the rest of the product will be pounds.

EXAMPLE FOR ILLUSTRATION.

1. 498 yards of flannel, at 6s. per yard. Ans. 149*l.* 8s.

498
3 half the given price.
——
149 8
l. s.

As directed in the rule, I multiplied by 3, half of the given price, saying 3 times 8 are 24, the double of 24 is 48 shillings, or 2*l.* 8s. set down the 8 shillings, and carry 2 to the pounds; then 3 times 9 are 27, and 2 that I carry, are 29; set down 9 and carry 2, then 3 times 4 are 12, and 2 are 14, which being set down, showed the result to be 149*l.* 8s. the answer.

2. 596lbs. of pepper, at 2s. per lb. Ans. 59*l.* 12s.

Here multiply by 1, (this being half of the price,) saying, once 6 are 6, the double of 6 are 12; which put down for shillings, and proceed.

3. 94lbs. of young hyson tea, at 8s. per lb. Ans. 37*l.* 12s.
4. 62lbs. of hyson tea, at 10s. per lb. Ans. 31*l.*
5. 98lbs. of indigo, at 14s. per lb. Ans. 68*l.* 12s.

CASE V.

When the price consists of any odd number of shillings under 20.

RULE.

[illegible] he given quantity by the price, and the product [illegible] wer in shillings, which divide by 20, to bring the

EXAMPLE FOR ILLUSTRATION.

1. 196 bushels of wheat, at 13s. per bushel.

Ans. 127*l.* 8s.

```
      196
       13
     ----
      588
      196
     ----
 2|0)254|8
    -----
    127  8
     l.  s.
```

Here, I multiplied by 13s. the given price, and divided the product by 20, the shillings in a pound.

2. 75 pair of shoes, at 9s. per pair. Ans. 33*l.* 15s,

3. 169 gallons of brandy at 11s. per gallon.

Ans. 92*l.* 19s,

CASE VI.

When the price is the aliquot, or even part of a pound, consisting of shillings, or shillings and pence. As 5s. which is the $\frac{1}{4}$; or 2s. 6d. which is the $\frac{1}{8}$ of a £. &c.

RULE.

Divide by the aliquot, or even part, and the quotient will be the answer in pounds.

Note. If there be a remainder, it will be pounds, which must be brought into shillings, and divided by the same divisor; if there still be a remainder, it will be shillings, which bring into pence, and divide as before; if there be any remainder to the pence, reduce it to farthings and divide again.

EXAMPLE FOR ILLUSTRATION.

1. 163 yards of calico, at 2s. 6d. per yard.

Ans. 20*l.* 7s. 6d.

```
|s. d.
|2  6|⅛|163
        -----
        20  7  6
        £.  s. d.
```

Here, I said, 2s. 6d. is [illegible] of a pound* I then divided by 8, saying, 8 into 16 twice 8 into three 0 times, and 3 over; this remainder is pounds, (as observed in the note,) which I brought into shillings, saying, 3 times 20 are 60; eight into 60, seven times, and 4, (shillings,) over; these I brought into pence; saying, 4 times 12 are 48: eight into 48, six times; the result was 20*l.* 7s. 6d. the answer.

2. 134 bushels of corn, at 5s. per bushel. Ans. 33*l.* 10s.

Say, 5s. is the —— of a pound.

---

* 163 bushels, at 1*l.* per bushel is 163*l.* and as 2s. 6d. is the ⅛ pound; *⅛ of the 169,* will be the answer required.

3. 210$\frac{1}{2}$ yards of silk, at 6s. 8d. per yard.

Ans. 70*l.* 3s. 4d.

6s. 8d. is the —— of a pound. For the 210$\frac{1}{2}$ bushels, place 210£. 10s.

4. 194 bushels of oats, at 3s. 4d. per bushel,

Ans. 32*l.* 6s. 8d.

Say, 3s. 4d. is the —— of a pound.

5. 240$\frac{3}{4}$lbs. of butter, at 1s. 8d. per lb. Ans. 20*l.* 1s. 3d.

For the $\frac{3}{4}$, place 15s.; for the part, say 1s. 8d. is the —— of a pound.

CASE VII.

When the price is shillings and pence, and said price not the aliquot, or even parts of a pound.

RULE.

Multiply the given quantity, by the shillings in the given price, and take parts for the pence, &c. add them together, and their sum will be the answer in shillings, which divided by 20, will bring the pounds.

EXAMPLE FOR ILLUSTRATION.

1. 219lbs. bohea tea, at 2s. 9$\frac{1}{2}$d. per lb. Ans. 30*l.* 11s. 4$\frac{1}{2}$d.

```
|6|½|219
| | |  2
| | |————
| | |438
|3|½|109  6
|½|⅙| 54  9
|     9  1½
|   ————————
 2|0|61|1 4½
    ————————
    30 11 4½
     l. s. d.
```

In this question, I multiplied by 2, the shillings in the given price; and took parts for the 9$\frac{1}{2}$d.; saying, 6d. is the $\frac{1}{2}$ of a shilling; 3d. is the $\frac{1}{2}$ of 6d.; and $\frac{1}{2}$d. is the $\frac{1}{6}$ of 3d.; after the division was ended, I added the whole together, and divided the sum by 20, the shillings in a pound.

Note. The remainder, when dividing by the parts, is shillings, to be brought into pence; and so on.

2. 68lbs. of feathers at 3s. 6$\frac{1}{2}$d. per lb. Ans. 12*l.* 0s. 10d.

In this question, multiply by the 3s. and take parts for the 6$\frac{1}{2}$d. as before taught; saying, 6 is the —— of a shilling; and $\frac{1}{2}$, is the —— of six pence.

3. 29 bushels of salt, at 5s. 7$\frac{3}{4}$d. per bushel.

Ans. 8*l.* 3s. 8$\frac{3}{4}$d.

Multiply by the shillings in the given price; and say, 6d. is the —— of a shilling; 1d. is the —— of 6d, $\frac{1}{2}$d. is the —— of a penny; and lastly, $\frac{1}{4}$ is the —— of a $\frac{1}{2}$d.

4. 165 yards of lace, at 6s. 9$\frac{1}{4}$d. per yard.

Ans. 55*l.* 17s. 2$\frac{1}{4}$d.

Multiply by the shillings in the price; then take parts for 9$\frac{1}{2}$d.

5. 19 loads of wood, at 19s. 11$\frac{3}{4}$d. per load.

Ans. 11*l.* 19s. 9d.

the 19, then take parts for 11$\frac{3}{4}$d. (See 46 ex. case 2.)

CASE VIII.

When the price is pounds, shillings, and pence; and the shillings and pence, the aliquot parts of a pound.

RULE.

Multiply the given quantity by the pounds, and take parts for the shillings and pence, as in case 6; add the whole together, and the sum will be the answer in pounds,

EXAMPLE FOR ILLUSTRATION.

1, 13 cwt, of sugar, at 5*l*, 2s, 6d. per cwt,
Ans, 66*l*, 12s, 6d,

s. d.
2 6 | $\frac{1}{8}$ | 13 at 5£. 2s. 6d.
5
—
65
1 12 6
————
66 12 6
£. s. d.

I multiplied by the 5 pounds, and then took parts for the 2s. 6d.; saying, 2s. 6d. is the $\frac{1}{8}$ of a pound, the quotient I added to the product above, which brought 66*l*. 12s. 6d. the answer.

2. 30 pieces of silk, at 6*l*, 6s. 8d. per piece, Ans, **190*l*.**

Multiply by the pounds; then say, 6s. 8d. is the —— of a pound.

3. 26 pieces of crape, at 3*l*. 3s. 4d. a piece.
Ans. 82*l*. 6s. 8d.

Proceed as before; for the parts say, 3s. 4d. is the —— of a pound.

Note.—When the price is pounds, only, multiply the given quantity by said pounds; and the product will be the answer.

4. 14 acres of land, at 15*l*. per acre. Ans. 210*l*.

CASE IX.

When the price is pounds, shillings, pence and farthings; and the shillings, &c. are not the aliquot parts of a pound.

RULE.

Reduce the pounds into shillings, (adding in the shillings in the price,) then, multiply the given quantity by the shillings and take parts for the pence and farthings, add the whole together, and their sum will be the answer in shillings, which bring into pounds.

EXAMPLE FOR ILLUSTRATION.

1. 49 barrels of apples, at 1*l.* 19s. 9¼d. per barrel.

Ans. 97*l.* 8s. 9¼d.

6	½	49	at 1*l.* 19s. 9½d.
		39	20
		441	39
		147	
3	½	24	6
¼	1/12	12	3
		1	0¼
	2|0	194(8	9¼
		97 8	9¼
		l. s.	d.

I first multiplied by 20, to reduce the pounds, &c. to shillings, adding in the 19 shillings; this produced 39 shillings; then I multiplied the given quantity by the 39s. and took parts for 9½d, after dividing by each, I added the whole together and divided the sum by 20, which brought 97£. 8s. 9¼d. the answer.

EXAMPLES.

2. 12 cwt. of tobacco, at 3£. 17s. 4¾d. per cwt.

Ans. 46*l.* 8s. 9d.

Bring the pounds into shillings, as before; and multiply the given number of cwt. by them, then take parts for the 4¾d.; saying, 4d. is the — of a shilling; ½d. is the - —— of 4d.; ¼d. is the —— of ½d.

3. 12 cwt. of steel, at 4£. 11s. 8¼d. per cwt.

Ans. 55£. 0s. 3d.

(For the 8¼d. see 31st. example case 1.)

4. 15 years rent, 12£. 7s. 1¾d. a year. Ans. 185£. 7s. 2½d.

5. 17 gallons of copal varnish, at 1£. 19s. 11¾d. per gal.

Ans. 33£. 19s. 7¾d.

The parts of 11¾d. have been taken; proceed as before.

Note.—When the price is pounds and shillings only; multiply the given quantity by the pounds, and take parts for the shillings; the sum of these will be the answer. Or, reduce the price to shillings; multiply the quantity by them, and divide the product by the shillings in a pound; the result will be the answer.

6. 17 casks of powder, at 5£. 8s. per cask. Ans. 91*l.* 16s.

Multiply by the pounds, and then take parts saying 4s. is the —— of a pound; again 4s. is the —— of a pound; divide the upper line, or given number, by both parts, then add the whole together. Or, bring the 5£. 8s. into shillings, multiply the product under the 17 casks, and divide the result by 20, the shillings in a pound.

CASE X.

When the price, or quantity given, are of several names, or denominations.

RULE.

Multiply the price of one by the highest denomination given, and take parts of the price for the remaining denominations; add the whole together; their sum will be the answer.

EXAMPLES FOR ILLUSTRATION.

1. If 1C. of cheese cost 6£ 7s. 4¼d. what is 5C. 2qrs. 19lbs. worth? Ans. 36£. 2s. 0¼d.

C.	qrs.	lbs.	qr		£	s.	d.
5	2	19	2	½	6	7	4¼
							5
					31	16	9¼
			16	1/7	3	3	8
			2	1/8	0	18	2¼
			1	½	0	2	3¼
					0	1	1½
					36	2	0¼
					£.	s.	d.

I first multiplied by the 5C. by Compound Multiplication; then I took parts for the 2 qrs. 19lbs. saying 2qrs. is the ½ of a C.; then, as the 19lbs. were not the even parts of a C, nor of 2qrs. I said, 16 lbs. are the 1/7 of a C. (the given price must be divided by this likewise, as the parts were taken from a C.) next, I said, 2lbs. is the ⅛ of 16; and lastly, 1lb. is the ½ of 2; there were some remainders, when dividing, which being less than a farthing, were rejected. After dividing by all the divisors, I added the whole together, the sum of which was the answer.

2. What is the value of 6C. 3qrs. 26lbs. of sugar, at $14.38c. per C.? Ans. $100.40cts. 2m.

C.	qrs.	lbs.			$ cts.
6	3	26	2	½	14.38
					6
					86 28
			1	½	7 19
			16	1/7	3 59 5
			8	½	2 05 4
			2	¼	1 02 7
					25 6
					100 40 2

After placing the quantity and price as before, I multiplied by the 6C; and then said, 2 qrs. is the ½ of a C. 1 qr. is the ½ of 2. then for the 26lbs. I said, 16lbs' is the 1/7 of a C; 8lb. is the ½ of 16; and 2lbs. is the ¼ of 8; as the 16lbs. were taken from the C, I divided the given price by the 7. The remainder, less than mills, I rejected; after the division was ended, I added the whole together as before, the sum of which, $100.40cts. 2m. was the answer.

EXAMPLES.

3. What is the value of 12C 3qrs. 14lbs. of tallow, at $12.87 cts. per C.? Ans. 165D. 70cts. 1m.+

Multiply by the 12C. then take parts for the qrs. and lbs. saying 2qrs. is the —— of a C.; 1 qr. is the —— of 2qrs.; 14lb. is the —— of 1 qr.

4. If you purchase 9C. 2qrs. 7lbs. of tobacco, at $8.95cts. per C. what does the whole come to? Ans. $85.58cts. 4m.+

Multiply by the 9C. then say, 2qrs. is the —— of a C.; 7lbs. is the — of 2qrs.

5. What is the worth of 7C. 3qrs. 22lbs. of hides, at 1£ 17s. 4d. per C.? Ans. 14£ 16s. 8d.

Take parts for the 3qrs. as in the 2d ex.; for the 22lb. say, 16lb. is the —— of a C. (which divide the given price by, as it is taken from the C.) then say, 4lb. is the —— of 16; lastly, 2lb. is the —— of 4.

6. If an ox, that weighs 11C. 0qrs. 19lb. be sold for $11.75 cts. per C, what does the whole come to?

Ans. $131.24cts. 3m.+

Here, you will have pounds only to take the parts for; as the parts for 19lbs. have been taken, I shall leave you to make trial.

7. If an anchor, that weighs 5C 2qrs 10lbs, be sold for $9.21 cts. per C, what does it come to? Ans. $51.47cts. 7m.+

For the parts, say, 2qrs. is the —— of a C.; 8lb. is the —— of 2qrs. 2lbs. is the —— of 8.

8. Suppose you purchase 3C. 3qrs. 24lbs. of hollow iron ware, at 10dolls. 29cts. per C. what does the whole come to?

Ans. 40dolls. 79cts. 2m.+

9. What will 8C. 1qr. 8lbs. of pork come to, at 2£ 12s. 6d. per C.? Ans. 21£. 16s. 10½d.

1qr. is the —— of a C; 8lb. is the —— of a C; the given price must be divided by both divisors.

◆

TARE AND TRETT.

Tare and Trett are practical rules for deducting certain allowances, which are made by merchants and tradesmen, in selling their goods, &c. by weight.

In this rule there are five things to be observed, viz. 1. the Gross weight; 2. the Tare; 3. the Trett; 4. the Suttle; and 5. the neat weight.

1. The *Gross weight* is the whole weight of any sort of goods, together with the box, cask, bag, &c. which contains said goods.

2. The *Tare* is an allowance made to the purchaser, for the weight of the box, cask, bag, &c. or whatever contains the goods; and is either at so much per box, &c. or at so much per Cwt. or, it is at so much in the whole gross weight.

s an allowance of 4lb. for every 104; that is,
vaste, dust, &c.

4. The *Suttle* is when part of the allowance is deducted from the gross.

5. The *neat weight* is what remains after all allowances are deducted.

CASE I.

When the tare is so much in the gross weight, to find the neat.

RULE.

Subtract the tare from the gross, and the remainder is the neat weight.

EXAMPLES FOR ILLUSTRATION.

1. What is the neat weight of 24 barrels of sugar, each weighing 2C. 3qr. 8lb. gross; tare in the whole 3C. 1qr. 21lb.?

Ans. 64C. 1qr. 3lbs.

C.	qr.	lbs.	
2	3	8	
		4	
11	1	4	
		6	
67	2	24	whole gross.
3	1	21	tare.
64	1	3	neat weight.

I set down the 2C 3qrs 8lb and instead of multiplying by 24, I multiplied by the parts as before taught; (that is, by 4 and 6;) after this was done, I placed the tare under the whole gross, and subtracted it; the remainder was the neat weight, or the weight of the sugar itself, without the barrels.

EXAMPLES.

2. What is the neat weight of 16 hogsheads of tobacco, each weighing 5C 1qr 17lbs, gross; tare in the whole 12C 1qr 27lbs?

Ans. 73C 3qrs 21lbs.

In this you may multiply by the parts; that is, by 4 and 4, as 4 times 4 are 16; then proceed as in the last example.

3. What is the neat weight of 3 hogsheads of sugar, weighing as follows:

	C.	qr.	lb.		C.	qr.	lb.
No. 1.	5	1	17	tare	0	1	17
2.	4	3	21		0	2	10
3.	6	1	19		0	1	27

Ans. 15C. 1qr. 3lbs.

Find the whole gross by adding the weight of the hhds. together; then find the whole tare by adding the tare of each hhd. together; place the tare under the gross and subtract it.

CASE II.

When the tare is at so much per box, cask, &c. to find the *weight*.

RULE.

Multiply the tare of each box, cask, &c. by the number of boxes, &c. given, the product of these subtract from the gross as before, and the remainder will be the neat weight.

Or, subtract the tare of one box, cask, &c. from the gross of 1 box &c. (in other words, find the neat weight of one box, &c.) then multiply by the number of boxes, &c. the product will be the neat weight.

EXAMPLE FOR ILLUSTRATION.

1. What is the neat weight of 10 firkins of butter, each 0C. 2qrs. 24lbs. gross; tare 10lbs. per firkin. Ans. 6C. 1qr. 0lb.

C.	qrs.	lbs.	
0	2	24	gross wt. of 1 firkin
0	0	10	tare of 1 do
0	2	14	neat wt. of 1 do
		10	
6	1	0	neat wt. of 10 do
C.	qr.	lb.	

I first deducted the tare of 1 firkin from the gross wt. of 1 firkin; this brought the neat weight of 1 firkin; I then multiplied by 10, the number of firkins; this product was the neat weight of the whole.

EXAMPLES.

2. What is the neat weight of 5 boxes of Havanna sugars, each weighing 3C 2qrs 19lbs, gross; tare per box, 1qr 21lbs? Ans. 16C 0qr 18lbs.

This question may be performed like the last.

3. What is the neat weight of 6 barrels of madder, each weighing 1C 3qrs 21lbs, gross; tare per barrel, 21lb? Ans. 10C 2qrs.

CASE III.

When the tare is so much per Cwt. to find the neat weight.

RULE.

Divide the gross weight by the part, or parts; the tare is of a Cwt; the quotient, or sum of the quotients, will be the tare. which subtract from the gross as before, the remainder is the neat weight.

EXAMPLE FOR ILLUSTRATION.

1. What is the neat weight of 8 casks of rice, each weighing 4C. 1qr. 6lbs. gross; tare 18lbs. per Cwt? Ans. 28C. 3qrs. 18lbs.

```
           C.  qr. lb.
  |   |   | 4   1   6
  |   |   |         8
  |   |   |-----------
  |16 |1/7|34   1  20
  |   |   |-----------
  |  2|1/8| 4   3  18+
  |   |   | 0   2  12+
  |   |   |-----------
  |   |   | 5   2   2 tare.
          ------------
           28   3  18 neat.
           C.  qr. lb.
```

I multiplied by the number of casks, then, took parts for the 18lbs; saying, 16lbs. is the $\frac{1}{7}$ of a C, and 2lb is the $\frac{1}{8}$ of 16; after dividing, I added the quotients together; this brought the tare, which I subtracted from the whole gross; the remainder was the neat weight required; the remainder, less than pounds, I omitted.

EXAMPLES.

2 What is the neat weight of 11 bales of silk, each weighing 1C. 2qrs. 14lbs, gross; tare 14lbs. per cwt.?

Ans. 15C. 2qrs. 15lb. 12oz.

Multiply the given weight by the number of bales; and then, take parts for the 14lbs. saying, 14lbs. is the —— of a C, &c.

3. What is the neat weight of 24 casks of raisins, each weighing 1C. 3qrs. 17lb, gross; tare per cwt. 19lbs.

Ans. 37C. 3qrs. 16lb. 14oz.

Instead of multiplying by 24, multiply by the parts; that is, 4 and 6, because 4 times 6 are 24; then, for the parts; say, 16lbs. is the —— of a C. 2lbs. is the —— of 16; and 1lb. is the —— of 2lbs; and proceed.

When the tare is so much per 100lbs.

RULE.

Multiply the pounds by the tare per cent. and divide the product by 100; (if there be a remainder, multiply by 16, the ounces in a pound, and divide again; this will bring the ounces;) subtract the quotient thus found, from the gross; the remainder will be neat. Or, divide the gross by the aliquot part, or parts, of 100lbs, and subtract the quotient, or sum of the quotients, from the gross; the remainder will be neat.

EXAMPLES.

1. What is the neat weight of 12C 3qrs 22lbs of raisins; tare 12lb per 100lb? Ans. 11C. 1qr. 16lbs.

```
           C.  qr.  lb.
 |10|1/10|12   3   22
 |  |    |-------------
 | 2| 1/5|
```

Divide by the parts as taken, add them together, and subtract the amount from the gross; the remainder will be neat.

2. What is the neat weight of 7C. 2qrs. 20lb. of figs; tare 15lb. per 100lb? Ans. 6C. 2qr. 3lbs.

For the parts, say, 10lb. is the —— of 100; 5lb. is the —— of 10; go on as directed.

CASE IV.

When trett is allowed with tare, to find the neat weight.

RULE.

Find the tare, as before, and subtract it from the gross; the remainder will be the suttle, which divide by 26; the quotient will be the trett, which must be subtracted from the suttle; this last remainder will be the neat weight.

EXAMPLE FOR ILLUSTRATION.

1. What is the neat weight of 12C. 2qr. 8lb. gross; tare in the whole 2C. 3qrs. 16lbs; trett 4lb per 104lb?

Ans. 9C. 1qr. 7lbs. neat.

	C.	qr.	lb.	
	12	2	8	gross
	2	3	16	tare
26)	9	2	20	suttle
	0	1	13 ½	trett
	9	1	7	neat
	C.	qr.	lb.	

In the first place, I subtracted the tare from the gross; the remainder is called the suttle; then I said, 4lb is the $\frac{1}{26}$ of 104. I divided by the 26, this brought 0C. 1qr. 13lbs. for trett, and 21 remainder; (this remainder would have brought 12 ounces, had I multiplied by 16, the ounces in a pound; and divided by the 26 again,) lastly, I subtracted the trett from the suttle; this left 9C. 1qr. 7lb. for neat.

EXAMPLES.

2. What is the neat weight of 10 bags of coffee, weighing together, 14C. 2qr. 12lb. gross; tare in the whole 1C. 0qrs. 8lb.

Ans. 13C. 0qr. 2lbs.+

By examining the rule and the examples for illustration, I think you may go along with the question.

3. What is the neat weight of 8 boxes of tea, each weighing 0C. 3qr. 11lbs. gross; tare per box, 10lbs. trett, 4lbs. per 104?

Subtract the tare of 1 box from the gross weight of 1 box, and multiply by the number of boxes, the product will be the suttle; then say, 4lbs. is the $\frac{1}{26}$, &c.

4. What is the neat weight of 12C. 3qrs. 7lbs. gross, allowing tare, 16lbs per cwt. and trett, 4lbs per 104? Ans. 10C. 2qrs. 7lb.

Take parts for the tare, for 16lb. say, 16lb. is the —— of a C; deduct this [illegible], for the trett, say, 4lb. is the —— of 104, and so on.

5. What is the neat weight of 8 hogsheads of sugar, weighing

	C.	qr.	lb.	
No. 1.	5	2	21	Tare, 10lbs per 100lbs.
2.	6	1	16	Trett, 4lbs. per 100.
3.	4	3	25	Ans. 14C. 3qr. 1lb.+

Add the weight of the hhds. together, then, take parts for the 12lbs. saying 10lbs. is the —— of 100; 2lb. is the ——— of 10; add the quotients together, and deduct the sum from the gross weight; then say, 4lb. is the——— of 104; and subtract the quotient brought from the suttle, the remainder will be the neat.

PROMISCUOUS QUESTIONS.

For Exercise in the Rule of Three Direct, the Rule of Three Inverse, Practice, and Tare and Trett.

1. What is the value of 2 hogsheads of sugar, each weighing 5C. 3qrs. 19lbs. gross; tare per hhd 38lbs, if sold at $14.48cts. per C? Ans. $161.60cts. 7m.+

Find the neat weight, by case 2d, Tare and Trett; find the value of the sugar, by case 10th, Practice. To help you along, I will say, that the neat weight is 11C. 0qr. 18lbs. Try and see if it is. To find what the sugar comes to, multiply the price by 11C. and take parts for the 18lbs. saying, 16lbs. is the — of a C. 2lbs. is the — of 16.

2. Suppose that you should ship from New Orleans, 35hhds. of molasses, which, upon an average, contained 103 gallons each, the purchase price being 18 cents per gallon; the freight 9cts. per gallon. What is the whole cost, after paying 3cts. per gallon duty on landing. Ans. 1081D. 50cts.

Add the whole cost together, and then state it, making the 35hhds. each 103 gallons, the 3d term. This is Direct Proportion.

3. Suppose that from the above quantity of molasses, 2 hogsheads be lost, the hogsheads being damaged, so that the molasses leaked out; what does the remainder stand you in per gallon? Ans. 31cts. 8m. 618rem.

Subtract the 2hhds lost, from the whole number, and make the remainder, each 103 gallons, the 1st term; and the whole cost the 2d; and proceed.

4. If you charter a vessel, to carry to a foreign port 96hhds. of sugar, which upon an average, weigh 8C. 2qrs. 14lbs. gross; tare per hhd. 56lbs. how much will the freight amount to, at 1½cts. per lb. for the neat weight of the sugar. And suppose the captain takes the freight in sugar, at 14dolls. 50cts. per cwt. how much of the cargo must he retain, to be compensat *for the freight?* *Ans.* The freight comes to 1310D. 40

The amount of sugar retained

freight is 90C. 1qr. 13lbs. 1

Find the neat weight of the sugar thus; from the gross of 1 hhd. subtract the tare of 1 hhd.; then ——— by the number of hhds.; after you have found the neat weight, state the question, making the whole quantity the third term. To find what the captain is to have, say, as the price of 1C. is to 1C. so is what the freight comes to —— to ——.

6. Suppose you sell 480 sheep, at 17s. 3½d. per head, what does the whole come to? Ans. 415*l*.

This may be done by case 7th. Practice, or Rule of Three Direct.

Suppose a farmer is indebted to a merchant for sundry articles, to the amount of 109*l*. 17s. 6d. and he wishes to settle the account, but not having the cash, concludes to pay the [illegible] grain; the question is, how much rye, at 6s. 6d. per bushel will discharge the account? Ans. 338bush. 2qts. 36 rem.

This being an easy question to state, I shall leave you to work it yourself; after observing, that the 6s. 6d. must be the first term.

The following bill, is a trial for Practice.

New York, January 1st. 1831.

Mr. A. Speculator,

Bought, of I. Want & Co.

			l.	s.	d		*l*,	s.	d
33	yards	of Bombazet, at	0	4	0	per yd.			
21	do.	Kerseymere,	0	11	4½				
18	do.	Cambric Muslin,	0	3	4				
61	do.	Tow Cloth,	0	0	11				
19	do.	Superfine bd. cloth	2	17	6				
430	do.	Wide Tape,	0	0	0½				
21	do.	Holland,	0	1	7½				
14	do.	Blk Muslin,	0	3	0				
5	do.	Common bd cloth,	1	3	4				
8	do.	do. do.	1	11	0				
14	do.	Coating,	1	0	0				
						Amount	*l*115	18	0

Received payment, for I. Want, & Co.

C. Measure, Cl'k.

The amount of the articles in this bill, may be found by the following cases of Practice; the first article by case 4. The second by case 7th. the third by case 6th. the fourth by case 2d. the fifth by case 9th. the
case 1st. the seventh by case 3d. the eighth by case 5th. the
case 8th. the tenth by the note in case 9th. and the eleventh
e in case 8th.

ose there is a vessel, that has a pipe that will empty
rs; how many pipes of the same capacity will empty
utes? Ans. 30 pipes.

d by Inverse proportion, and stated thus; 5hrs. 1P. 10min.

INTEREST.

Interest is of two kinds Simple and Compound.

SIMPLE INTEREST.

Simple Interest, is that which arises from the principal only, and is the sum, that the borrower pays to the lender, for the use of money lent for some determined space of time, at any rate per cent. per annum agreed upon, which in several States is fixed at 6 per cent. per annum.* I would have the learner understand what is meant by per cent. per annum, and to do this, *Observe.* When it is said, at 6 per cent. per annum, it means that the borrower must pay the lender, 6*l.* for the use of 100*l.* or $6. for the use of $100, for a year.

The four following particulars relate to Interest:

1. The *principal*, which is the sum lent; or the money for which interest is to be received:
2. The *rate*, per cent. per annum; this is what the borrower has to pay the lender, for the use of 100*l.* or $100. for a year:
3. The *time*, is the number of years, months, or days, &c.
4. The *amount*, which is the sum of the principal, and interest added together.

NOTE.—The rules for Simple Interest serve also to calculate Commission, Brokerage, Insurance, Purchasing of Stock, or any thing else rated at so much per cent.

CASE I.

To find the interest of any sum of money, for one, or more years.

RULE.

Multiply the principal by the rate per cent, and that product by the number of years, then divide the last product by 100; the quotient will be the interest required.

---

* In New York, at 7 per cent. per annum.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 26*l*. 16s. 4d. for 2 years, at 6 per cent. per annum. Ans. 3 . 4s. 4d. 1qr. 28 rem.

```
   l.    s.    d.
   26    16    4
               6
 ------------------
  160    18    0
               2
 ------------------
l3.21    16    0
   20
 -----
s 4 36
   12.
 -----
d 4.32
     4
 -----
qr 1.28
 -----
```

This question can be performed by the Rule of Three Direct; stating it in the following manner; If, 100*l*. give 6*l*. what will 26*l*. 16s. 4d. give; this operation would bring the same result as the method here laid down; but, according to the rule, I multiplied by the rate per cent. and then, that product by the number of years; the rule says, divide the last product by 100, but the operation is shortened by pointing off two figures, (of the pounds,) from right to left, as in the example; the figure, or figures, to the left of the point, being pounds. In this manner I proceeded to point off, then multiplying the figures cut off, (to the right from the pounds;) by 20, the shillings in a pound; adding in the 16 shillings; and then I pointed off two figures as before, and multiplied by 12, the pence in a shilling; here, I had 0 pence to add in; I then multiplied the figures cut off from the pence, by 4, the farthings in a penny; *Observe*, the figures to the left of each point of separation are the pounds, &c. the interest required; the interest found is, 3*l*. 4s. 4d. 1qr. and 28 remainder. Pointing off in this manner, brings the same answer as dividing by 100; as before taught.

2. What is the amount of 264 dollars 38 cents for 2 years, at 6 per cent per annum. Ans. 296 dolls. 10cts. 5m. 6 rem.

```
   D.cts.
   264.38
        6
  -------
  1586.28
        2
  -------
 31.72.56
```

I placed the dollars and cents, as you see; then multiplied by the rate per cent. proceeding as though they were whole numbers; I next multiplied by the 5 years, and then pointed off two figures from the right of the product, (which is the same as dividing by 100 at large,) again, I pointed off two more figures for cents, the figures to the left of the last mentioned point were dollars.

Or, to make it plainer, you may write down the given principal in cents, which multiply by the rate and time, and divide by 100, as before; and the interest in cents, which bring into dollar

Particular attention must be paid to the pointing off, which may be understood, by attending to the manner this question is done; what were the first figures pointed off for? I answer for dividing by 100, as per rule; then, the next two figures were for dividing by 100, the cents in a dollar; the figures cut off were cents, the rest (to the right,) were dollars; there were two figures in the remainder, (56,) I pointed off the 5 for mills, (which was the same as dividing by 10, the mills in a cent,) so that the interest found reads thus; $31.72cts. 5m. and 6 rem. as the amount was required, I added the principal, 264.38cts. to the interest, the sum was $296.10cts. 5m. and 6 remainder, the answer.

EXAMPLES.

3. What is the interest of $89.27cts. for 1 year, at 7 per cent per annum? Ans. 6D. 24cts. 8m. +.

As the time is one year, you need not multiply by it. as it would stand the same; but proceed according to rule; that is, multiply by the rate per cent. and point off as before directed.

Finding the interest for dollars and cents is much easier than pounds, shillings, and pence, the work being shorter, and less difficult to perform.

4. What is the amount of 15*l.* 10s. 6d. for 5 years, at 6 per cent. per annum? Ans. 20*l.* 3s. 7d. 3qrs. +

Write down the given sum, and multiply by the 6 per cent. then multiply that product by the 5 years; point off the pounds as before taught, and multiply by the shillings in a pound, &c. remember the amount is required. The principle is the 15*l.* 10s. 6d.

5. Suppose you have a note against a man for $158.20cts. and it has stood 3 years, what is the interest due on it, at 5 per cent per annum? Ans. 23D. 73cts.

Examine the 2d, ex. for illustration. The interest only is required.

6. What is the amount of a note given for $468 dollars that has been standing 5 years, at 6 per cent. per annum? Ans. 608D. 40cts.

As this question consists of dollars only, you must cut off two figures from right to left, those to the left will be dollars, and those to the right cents.

7. How much interest is due on a note, given for $2648 29 cts. that has been standing 4 years, at 6 per cent. per annum? Ans. 635D. 58cts. 9m.

CASE II.

When the rate per cent. is $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, &c. more than pounds or dollars, given in said rate, as $4\frac{1}{4}$, $5\frac{1}{2}$, $6\frac{3}{4}$, &c. which means $4\frac{1}{4}$ *dollars, or $4\frac{1}{4}$ pounds, &c.*

RULE.

Multiply the principal, by the pounds or dollars, in th per cent. and take, ¼, ½, ¾,* &c. of the principal, which, add to the product, and divide the sum by 100, as before; the result will be the interest required.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 41*l.* 14s. 6d. for 2 years, at 5¾ per cent. per annum? Ans. 4*l.* 15s. 11d. 2qrs. 44 rem.

	l.	s.	d.		
½ ½	41	14	6		
			5¾		
	208	12	6		for 5 per cent.
¼ ½	20	17	3		for ½ do
	10	8	7	2	for ¼ do
	239	18	4	2	for 5¾d.
				2	
	*l*4.79	16	9	0	
	20				
	s 15.96				
	12				
	d 11.61				
	4				
	qr 2.44				

According to rule, I multiplied by the pounds in the rate per cent, and then took parts for the ¾, saying, ½ of a pound is the ½, and ¼ of a pound is the ½ of that; after dividing by the parts, I added the whole together, and then multiplied by the number of years; after I had pointed off two figures from right to left in the pounds, I multiplied by 20, the shillings in a pound; by 12, the pence in a shilling and by 4, the farthings in a penny, pointing off as before.

---

* Note for ¼, take the fourth part of the principal, saying ¼ is the ¼; for ½, take half of the principal; for ¾, take parts compound of ¾; thus, say ½ is the ½; then ¼ is the ½ of that. For the rule for multiplying by 4½, &c. see page 60.

2. What is the interest of $149.21cts. for 3 years at 6¼ per cent per annum? Ans. $27.97cts. 6m. 8 rem.

```
      D. cts.
|¼|¼|149.21
|  |  |    6¼
|  |  |------
|  |  |895 26
|  |  | 37.30
|  |  |------
|  |  |932.56*
|  |  |     3*
     ------
   27.97.6,8
   $. cts m.
```

After multiplying by the dollars in the per cent. I took parts for ¼, saying ¼ of a dollar is the ¼; then I multiplied by the years as before, and pointed off two figures; that is, divided by 100; as the figures to the left were cents, I pointed off two more, to separate the dollars from the cents. From 68 remainder, I pointed off one figure for mills, the result was $27 97cts. 6m. and 8 remainder for answer.

EXAMPLES.

3. What is the interest of 721dolls. 46cts. for 5 years at 6½ per cent. per annum? Ans. $234.47cts 4m +

Go according to rule. For the parts say, ½ of a dollar is the —— of a dollar.

4. If a note be given for 81*l.* 17s. 4d. and after standing 4 years, is paid up, what is the amount of it at 6¾ per cent. per annum? Ans. 103*l.* 19s. 4d. 3qrs. +.

Proceed to find the interest as before, and as the amount is required, add the interest found to the principal, (81*l.* 17s. 4d.) the sum will be the answer.

CASE III.

When the interest is for ¼, ½, ¾, &c. of a year, or any number of years besides.

RULE.

Find the interest for the years as before, that is multiply by the per cent. and then by the years, (if any,) and take ¼, ½, ¾* &c. the interest of one year, which add to the interest for the years, (if any,) and divide the sum by 100, as before.

---

* In taking ¼, ½, ¾, &c. of the interest, see note case 3d.

EXAMPLES FOR ILLUSTRATION.

1. What is the interest of 17*l*. 10s. for 2¾ years, at 5¼ per cent per annum? Ans. 2*l*. 10s. 6d. 1qr. 50 rem.

		l.	s.	d.	
¼	¼	17	10	0	
				5¼	
		87	10	0	
		4	7	6	
½	½	91	17	6	for 1 year.
				2¾	
		183	15	0	for 2 years.
¼	½	45	18	9	for ½ year.
		22	19	4½	for ¼ year.
		l. 2.52	13	1½	for 5¾ years.
		20			
		s.10.53			
		12			
		d.6.37			
		4			
		qrs.1.50			

I first muliplied by the rate per cent. then for the ¼ I said, ¼ is the ¼; after dividing, I added these together, and multiplied by the [illegible] years, and took parts for the ¾ of a year, saying, ½ is the ½, and ¼ is the half of that; after dividing, I added them together, and pointed off two figures, then multiplied by 20, &c. as before.

EXAMPLES.

2. What is the interest of $469.28cts. for 3¼ years, at 4½ per cent. per annum? Ans. 68D. 63cts. 2m. +

For the ½ in the per cent. say, ½ is the ½, and for the quarter in the year, say, ¼ is the ¼.

3. What is the interest of 1279 dollars for 4¾ years, at 5¾ per cent. per annum? Ans. 349D. 32cts. 6m. +

Multiply by the per cent. then by the years; point off as before.

4. What is the amount of a note given for 48*l*. that has been standing 2¼ years, at 6½ per cent. per annum?

Ans. 55*l*. 0s. 4d. 3qrs. +

The amount is the principal and interest, added together.

CASE IV.

When the interest is required for any number of months, or any number of years and months.

RULE.

Find the interest for the years as in the last case, and then take parts from the interest of one year for the months.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 158 dolls. for 2 years and 5 months, at 4½ per cent. per annum. Ans. 17D. 18cts. 2m.+

		D.
½	½	158
		4½
		632
		79
4	⅓	711
		2
		1442
1	¼	237
		592+.
		1718.2

As before, I multiplied by the per cent. then by the years, and took parts for the 5 months; saying, 4 months it the ⅓ of a year, and 1 month the ¼ of 4 months; after dividing, I added the whole together, as in the last case, and pointed off as before taught. When dividing by 4, there was 1 remainder; this was 1 cent which I brought into mills, and divided by 4 again; this brought 2 mills and 2 remainder.

EXAMPLES.

2. What is the amount of a note given for 28*l.* that has been standing 9 months, at 6 per cent. per annum?

Ans. 29*l.* 5s. 2d. 1qr.

After you have multiplied by the per cent. take parts for the 9 months saying, 6 mo. is the —— of a year, and 3 mo. is the —— of 6; after dividing by both parts, add the quotients together, and point off as before. The amount is required.

3. What is the interest, on a note given for 450 dollars, that has been standing 2 years and 11 months, at 7 per cent. per annum? Ans. 91D. 87cts. 5m.

The parts for 11 months are taken the same as the parts for 11 pence.

4. Find the interest of $295·80cts. for 5 years and 5 months, at 5½ per cent. per annum. Ans. $88·12cts. 3m.

For the 5 mo. say, 4 mo. is the —— of a year, and 1 mo. is the —— of 4.

CASE V.

When the interest required, is for any number of

RULE.

Find the interest of the given sum for a year as before, then say; as 52 weeks are to said interest; so are the weeks given, to the interest required.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 289 dolls. 24 cts. for 21 weeks, at 6 per cent. per annum? Ans. 7D. 00cts. 8m. 18 rem.

```
  D.  C.
  289.24
       6
 -------
 17.35.4.4  int. for 1 year.
 -------
 stated thus.
W.    D.  cts.  m.   W.
As 52 : 17 . 35 . 4 :: 21
        100
       -----
        1735
          10
       ------
       17354
          21
       ------
       17354
      34708
      ------
52)364434(7 . 00 . 8
   364    D. cts.  m.
   ----
     434
     416
     ---
      18
     ---
```

I first found the interest of the given sum for a year, which was 17D. 35cts. 4m. and a remainder; I then stated it as directed, working it by the Rule of Three Direct, and got 7008 mills for answer; which being pointed off, brought 7dolls. 00cts. 8m and 18 remainder.

EXAMPLES.

2. What is the interest of 13*l*. 16s. 6d. for 19 weeks, at 7 per cent per annum? Ans. 7s. 0d. 3qrs. $\frac{22}{52}$.

Find the interest of the given sum for a year; then say, as 52 weeks are to said interest, so are the 19 weeks to ——

What is the amount of a note given for 500 dollars, that has been standing 28 weeks, at 6 per cent. per annum.

Ans. $516.15cts. 3m. $\frac{44}{52}$.

ule again, proceed as before. The amount is required.

CASE VI.

To find the interest of any sum, for any number of days.

RULE.

Find the interest of the given sum as before; then say, as 365 days is to said interest, so are the number of days given in the question, to the interest required.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 65*l.* for 110 days, at 5 per cent. per annum? Ans. 19s. 7d. 25 rem.

```
 l.     D.     l.  s.    D.
 65 as 365  :  3   5  :: 110
 5             20
 ----          ----
l3,25          65
   20          110
 ----          ----
s 5.00     365)7150(19s
               365
               ----
               3500
               3285
               ----
                215
                 12
               ----
           365)2580(7d.
               2555
               ----
                 25
                 --
```

As directed in the rule, I found the interest of 65*l.* the given sum for a year, which was 3*l.* 5s. I then stated the question, as in the margin; working according to the Rule of Three Direct; the result was 19s. 7d. and 25 rem. the interest required.

EXAMPLES.

2. Suppose you hold a note against a man for $328, what will it amount to, when it has stood 190 days, at 5 per cent. per annum? Ans. $366.53cts. 6m. $\frac{360}{365}$.

Find the interest of the $328 for a year; then state it as directed. Remember to add the interest found, to the principal.

3. What is the interest on a note, given for $50. from August 2d. 1830, to Christmas day following, at 6 per cent. per annum? Ans. $1.19cts. 1m. $\frac{285}{365}$.

Find the number of days as before taught. The number is 145. Although I have given the number, find it, and see if we agree in the calculation; after finding the days proceed as before.

4. *Suppose that on* new year's day, 1828, you give an

for 140£. how much is due on it, or what does it amount to, on the 24th day of April following, (it being leap year,) at 5 per cent. per annum? Ans. 142£. 4s. 1d. 1qr. $\frac{95}{365}$.

Find the number of days from January 1st. to April 24; write down —— days for February, it being leap year. The amount is required.

5. If a note for $420.25cts. be given on the 19th. day of June 1820. how much is the amount of said note on the 23d. day of February following, 1831, at 6 per cent. per annum? Ans. $437.45cts. 1m. $\frac{170}{365}$.

Find the interest of $420.25cts. for a year. Find the days and proceed.

6. What is the interest of 365 dollars from July 4th, 1828, to June 18th. 1831. at 5 per cent. per annum? Ans. $53.92cts. 9m.

Find the time as in the 10th ex. page 101; that is, write down the years, months and days in the last mentioned, (reckoning from January) then place the years &c. first mentioned, under them, and proceed. You may find the interest for the years and months by case 4th. then find the interest for the days, and add the result to the interest, for the years and months.

COMMISSION.

Commission is an allowance of so much per cent. from a merchant to his factor or correspondent abroad, for buying or selling goods, &c.

Note. The method for working questions in Commission is the same as case 1, and 2, Simple Interest.

EXAMPLE FOR ILLUSTRATION.

1. What will the commission of 128£. 10s. 6d. come to, at 4½ per cent? Ans. 5£. 15s. 8d.

	£	s.	d.
½ ½	128	10	6
			4½
	514	2	0
	64	5	3
£	5.78	7	3
	20		
s	15.67		
	12		

Performed the same as in case 2d. And as it is easy to be understood, I shall leav the learner to examine it for himself.

EXAMPLES.

2. If I purchase goods to the amount of $589.20cts. what does my commission come to at 5 per cent? Ans. $29.46cts.

3. Suppose I allow a correspondent 3½ per cent. for his commission; what is his demand on the disbursement of $749, 64cts? Ans. 26D. 23cts. 7m. +

4. If you employ a man to buy goods for you, to the amount of 250£. what does his commission come to at 2¾ per cent? Ans. 6£. 17s. 6d.

5. What is the deduction from a 20000 dollar prize, at 15 per cent? Ans. 3000 dolls.

BROKERAGE.

Brokerage is an allowance or fee paid to a Broker, for assisting merchants or factors in buying, or selling goods, &c.

To find the brokerage of any sum, at any rate under 1£. or $1. per cent.

RULE.

Find the interest of the given sum, at 1£ or $1 per cent. then take parts from it for the rate per cent. given; the quotient or sum of the quotients will be the answer.

EXAMPLES FOR ILLUSTRATION.

1. What is the brokerage of 350£. 17s.6d. at 5s. 6d.per cent? Ans. 19s. 3½d.

```
 £.    s.  d.   s.      £.  s.  d.
 350   17  6   |5| ¼  |3   10  2
            1  |d|    |---------
 -----------   |6|1/10|0   17  6½
 £3.50 17  6   | |    |0    1  9
   20          | |    |---------
  ----         | |    |0   19  3½
 s.10.17
     12
  ----
 d.2.10
  ----
```

I first found the brokerage at 1£. per cent. and took parts for the 5s. 6d.; saying, 5s. is the ¼ of a £. and 6d. is the $\frac{1}{10}$ of 5s. After dividing, I added the quotients together, which brought the answer.

EXAMPLES.

2. Suppose a broker sells goods for you to the amount of 295£. 10s. 6d. what is the brokerage at 12s. 6d. per cent? Ans. 1£. 16s. 10¾d. +

Find the brokerage at 1*l*. per cent. as before; then, for the given rate say, *10s. is the —— of a pound*; 2s. is the —— of 10s. and 6d. is —— *of 2s.*

3. What is the brokerage of 1500 dollars, at 57 cents per cent? Ans. 8D. 55cts.

To find the answer to the question, you may multiply the given number by the 57 cents per cent. and point off as before taught. This method brings the same answer, as taking parts of a dollar, for the 57cts.

4. What may a broker demand, if he has sold goods for you, to the value of 248*l.* 12s. 8d. if you allow him 1¼ per cent? Ans. 3*l.* 2s. 1d. 3qrs. +

This being above 1*l.* per cent. the operation is the same as Commission.

INSURANCE.

Insurance is a contract or agreement, whereby one or more persons, called insurers, &c. oblige themselves to pay for the loss, or damage of ships, houses, merchandize, &c. which may happen from storms; fire, &c. in consideration of a premium at so much per cent. paid by the proprietors of the thing insured.

If the premium or rate per cent. be less than 1*l.* proceed as in the last case, but if above 1*l.* as in Commission.

EXAMPLE FOR ILLUSTRATION.

1. Suppose you have a house, valued at 2650 dollars, and you get it insured against fire, at 1½ per cent. what does the insurance come to? Ans. 39dolls. 75cts.

```
      D.
|½|½|2650
|  |  |     1½
|  |  |------
     2650     I multiplied by the 1½ per cent and pointed off as
     1325   before,
     ----
     39.75
     $. cts.
```

2. If a ship valued at 4960*l.* be insured at 7¼ per cent. what does it come to? Ans, 359*l.* 12s,

3. Suppose you have goods in store to the amount of 3648 dollars, and you get them insured at 1¾ per cent. what does it come to? Ans. 63D. 84cts.

3, What is the insurance of an East India ship and cargo, valued at 87564 dollars, at 14¼ per cent. Ans. 12477dolls. 87cts,

PURCHASING OF STOCKS.

Stock is a name given to the funds, or capitals, of trading companies, banks, &c. and the buying and selling of certain sums of money, in those funds are not unusual.

RULE.

Multiply the sum to be purchased by the excess of the rate per cent. above 100; then, divide the product by 100, as before; and the quotient, added to the given sum, will give the required purchase.

Note. If under par, that is, if under 100 per cent, proceed as in Commission or Insurance.

EXAMPLE FOR ILLUSTRATION.

1, What is the purchase of 750*l.* bank stock, at 108½ per cent? Ans, 813*l*, 15s,

$$\begin{array}{|c|c|r}
\multicolumn{3}{r}{l.} \\
\frac{1}{2} & \frac{1}{2} & 750 \\
 & & 8\frac{1}{2} \\ \cline{3-3}
 & & 6000 \\
\multicolumn{3}{r}{375} \\ \cline{3-3}
\multicolumn{3}{r}{l\ 63{,}75} \\
\multicolumn{3}{r}{20} \\ \cline{3-3}
\multicolumn{3}{r}{s\ 15{,}00} \\ \cline{3-3}
\end{array}
\qquad
\begin{array}{rr}
l. & s. \\
750 & 0 \\
63 & 15 \\ \hline
813 & 15 \\
l. & s.
\end{array}$$

According to rule, I multiplied by the excess of the rate per cent. above 100, (or pointed off as before taught,) I multiplied by 20, to bring the shillings; and lastly, added the result, viz. 63*l*, 15s. to the given sum, which brought the answer required,

Note, The parts of 100 might have been taken for the 8½, which would have brought the same answer,

EXAMPLES.

2, What does 5550 dollars, capital stock in the United States Bank, come to, at 112¾ per cent? Ans, 6257 D, 62cts, 5m

Proceed as in the last example; that is, multiply by the excess, above 100, which is, 12¾, then add the result to the given sum.

3, What is the purchase of $1680 bank stock, at 95½ per cent? Ans, $1604.40cts,

This being below par, proceed as in Commission, &c. that is, multiply by the 95½ per cent, &c.

More cases of Simple Interest,

CASE VII.

When the amount, time, and rate per cent. are given to find the principal,

RULE.

Find the amount of 100*l.* or 100 dollars, at the rate and time given; then say, as the amount so found is to 100*l*, or 100 dollars so is the amount given, to the principal required.

EXAMPLE FOR ILLUSTRATION.

1. What principal, being put out to Interest for 7 years, at 5 per cent. will amount to 270*l*? Ans. 200*l*.

l. *l*. *l*. *l*.
100 as 135 : 100 :: 270
5 100
500 135)2700(200
7 270
35.00 00
100
135 *l*.

I found the amount of 100*l*. at the rate and time given; which was 135*l*. and then stated it according to rule; saying, if 135*l*. amount give 100*l*. principal, what will 270*l*. amount give for principal.

2. What principal, being put out to interest for 5 years at 6 per cent. will amount to 1040 dollars? Ans. 800 dollars.

Find the amount of 100 dollars, and proceed according to rule.

CASE VIII.

When the principal, amount and time are given, to find the rate per cent.

RULE.

Find the interest for the whole time; this is done by subtracting the principal from the amount; the remainder is the interest for the whole time. Then say, as the principal is to the interest thus found, so is 100*l*. or 100 dollars, to the interest for the same time.

Lastly, divide the interest found by the given time, and the quotient will be the rate per cent. required.

EXAMPLE FOR ILLUSTRATION.

1. At what rate per cent. per annum, will 800 dollars amount to 1040 dollars in 5 years? Ans. 6 dolls. per cent.

$. $. $. $.
1040 as 800 : 240 :: 100
800 100
240 8|00)240|00
time 5) 30
6 per cent.

After finding the interest for the whole time, I stated the question as in the margin. The result was $30 interest; which I divided by (5 years,) the time; this brought $6. per cent. the answer.

2. At what rate per cent. per annum, will 200*l*. amount to 270*l*. in 7 years? Ans. 5 per cent.

CASE IX.

When the principal, rate per cent. and amount are given, to find the time.

RULE.

Find the interest of the principal for 1 year; also, find the whole interest as in the last case. Then say, as the interest of the principal for 1 year is to 1 year, so is the whole interest to the time required.

EXAMPLE FOR ILLUSTRATION.

1. In what time will 200*l*. amount to 270*l*. at 5 per cent. per annum? Ans. 7 years.

l.
200
5
*l*10,00 int. of the prin.

l.
270
200
70 int. for the whole time.

l. y. *l*.
as 10 : 1 :: 70
1|0)7|0
7 yrs.

As directed in the rule, I found the interest of the principal for 1 year; then I found the whole interest as in the last case; after this was done, I stated it according to rule, &c.

2. In what time will $800 amount to $1040 at 6 per cent. per annum? Ans. 5 years.

For several methods of computing interest on notes, having endorsements. See Simple Interest, by Decimals.

COMPOUND INTEREST.

Compound Interest is interest upon interest, or it is that which arises from the interest being added to the principal, and, continuing in the hands of the borrower, becomes a part of the principal at the end of the stated time of payment. Thus, if 100 dollars be put out on interest, at 6 per cent. per annum, at the end of a year, there is 106 dollars, due the lender; this 106 dollars is the principal for the second year to draw interest, and so on.

RULE.

Find the amount of the principal for the first year by Simple Interest, and this amount will be a new principal for the second year. *Find the amount* of this new principal as before, an this amount will be the principal for the third year, &c. which will appear plain, from what follows. Suppose 100 dollars be reckoned at Compound Interest, at 6 per cent. per annum. The amount of this, for 1 year, is 106 dollars, which is the principal for the second year. The amount of 106 dollars is 112 dollars, 36 cents; this is the principal for the third year, &c.

Note. Subtract the given principal from the last amount; the remainder will be the Compound Interest.

EXAMPLE FOR ILLUSTRATION.

1. What is the amount of 220*l.* for 3 years, at 6 per cent, per annum, Compound Interest? Ans. 262*l.* 0s. 5d. 2qrs.

```
   l.                   l.   s.  d.                     l.
  220                  233   4   0 new prin.  or thus, 220
    6                   13  19  10 interest,             6
 ------               ------------                 -------
l. 13.20               247   3  10 2d year.          13.20
   20                            6                    220.
 ------               ------------                 -------
s. 4.00              l14.83  3   0                  233.20
                        20                               6
   l.  s.             ------                       -------
  220  0 prin.      s 16.63                       13.99.20
   13  4 int. 1st yr.   12                        233.20.
 --------             ------                   -----------
  233  4 amt. 1st yr.  7.56                     247.19.20
       6                 4                               6
 --------             ------                   -----------
l. 13.99 4             2.24                    14.83.15.20
   20                                          247.19.20.
 --------         £   s.  d. qr.               -----------
 s 19.84         247  3  10  0 new prin.   l. 262.0235.20
   12             14 16   7  2 interest.                20
 --------        ----------------             ------------
d 10.08          262  0   5  2 amt. 3d year.  s.  0.4704.00
                  l.  s.  d. qr.                        12
                                               -----------
                                              d.  5.6448.00
                                                         4
                                             qr.  2.5792.00
                                               -----------
```

Work out this question and examine it, before you proceed to the next.

EXAMPLES.

2. What is the amount of $350 for 4 years, at 4 per cent. per annum. at Compound Interest? Ans. $409. 45cts.+

By a careful attention to the rule, and the first example, you may get along with these questions.

3. What is the amount of £300 for 3 years, at 5 per cent. per annum. at Compound Interest? Ans. £347· 5s. 9d.

4. What is the compound interest of $400 for 5 years, at 6 per cent. per annum? Ans. 135D. 29cts.+

Proceed to find the amount as before; then, to find the compound interest, go according to the note given under the rule.

Observe—When the interest is required for months, or for months and days, besides years—find the interest for one year more than the given number of years; and from that year's interest find the interest for the odd time more than the years given in the question; add the interest thus found to the last amount; the sum will be the amount required.

Promiscuous Examples for Exercise in Interest.

1. What is the amount of 445D. for 5 months and 11 days, at 6 per cent. per annum.? Ans. 456D. 94cts.

Find the interest for one year; then say, 4 months is the — of a year; 1 month is the — of 4 months; then, 10 days is the ⅓ of 1 month, and 1 day is the — of 10 days.

2. What is the interest of 333D. 42cts. for 1¾ years, at 6½ per cent. per annum.? Ans. 37D. 92cts. 6m.+

Case 3, Simple Interest.

3. What is the amount of 269D. 94cts. for 3 years, and 10 months, at 5 per cent per annum? Ans. 321D. 67cts. 8m.+

When you take parts for the 10 mo. say 6 mo. is the — of a year, &c.

4. What is the interest of 948D. for 232 days, at 6 per cent. per annum? Ans. 36D. 15cts. 3m.+

5. What is the insurance on a store of goods, valued at 3260D. at ¾, or 75 per cent. Ans. 24D. 45cts.

6. What will the commission on 1268D. 60cts. come to, at 1¼ per cent? Ans. 15D. 85cts. 7m.+

7. What is the amount of a note, given for 239D. 42cts. that has been standing 4 years, at 6 per cent. per annum? Ans. 296D. 88cts.+

8. What is the interest of 948D. 94.cts for 28 weeks, at 5 per cent. per annum? Ans. 25D. 54.cts. 8m.+

9. What may a broker demand for the sale of goods to the amount of 2246D. at 1¾ per cent? Ans. 39D.30.cts.5m.

10. What is the amount of 225D.50cts. for 4 years, at 6 per *cent, compound interest?* Ans. 284D.68cts. 8m.

REBATE OR DISCOUNT.

REBATE, OR DISCOUNT, is a deduction or an allowance, made for the payment of any sum of money before it is due; or, it is a deduction made upon advancing the ready money for notes, bills, &c. which are due, or to be paid at some future day. Thus, suppose you purchase a quantity of goods and give your note for the same, to be paid 6 months from the date. If you pay the money before the time expires, the person holding the note makes a deduction for present payment, at some rate per cent. agreed upon for the time yet to come; and it is evidently right he should, as he would have the use of the money before it was due; this deduction is called the Rebate, or Discount; and what remains after the discount is deducted, is the present worth; and is such a sum, that, being put to interest, would amount to the given sum or debt, at the rate and time given.

RULE.

Find [illegible]mount of £100 or $100, at the given rate and time; that is, find the interest, and add it to the 100*l.* or 100 dollars; then state it as follows:

As the amount found, as above, is to the interest of £100 or 100 dollars first found, so is the given sum to the discount. Subtract the discount thus found from the given sum; the remainder will be the present worth.—Or,

As the amount of £100 or 100D. is to the 100, so is the given sum to the present worth.

PROOF.

Find the amount of the present worth at the given rate and time, and, if the work is right, it will be equal to the given sum.

EXAMPLES FOR ILLUSTRATION.

1. What is the discount on a note, given for 106D. due 1 year hence, at 6 per cent? Ans. 6 dollars.

```
  $         $     $      $
 100     as 106 : 6 :: 106
   6                     6
 ----                 ----
 6.00             106)636(6$
100                    636 disc't.
 ----                 ----
106     amount of 100D.
```

Here you will see, that, on a note due 1 year hence, there is 6 dollars for present payment; so by paying 100 dolls. down, the debt of 106 dollars, due one year hence, is discharged. It needs nothing more said, to prove

```
                                    $
To find the present worth, from   106
T[illegible]               nt,       6
                                  ----
          Present worth           100
```

this rule correct, than to examine this question; for the person, who receives the money, will, at the end of the year, still have 106 dollars; as the use of 100 dollars for 1 year is 6 dollars, which shows the rule to be upon equal terms between the debtor and creditor.

2. What is the present worth of a note given for £200, due 1 year and 6 months hence, at 6 per cent?

Ans. £183. 9s. 8d. 2qrs. 86 rem.

```
          £           £     £     £
         100     as 109 : 100 :: 200
           6              200
        ----            -----
|6|½|    600         109)20000 183£
|  |     1             109
|  |    ---            ---
|  |     600             910
|  |     300             872
        ----             ---
        9.00              380
      100                 327
      ----                ---
      109£                 53 &c.
```

I found the amount of £100 for 1 year and 6 months; this amount was £109; then I stated the question, saying, as the amount thus found is to £100, so is the given sum, &c. The reason why I placed £100 for the second term was, that the answer required the present worth. Had the question required the discount, then the interest of 100*l.* would have been the second term. I have left the question unfinished; the learner must find the shillings, pence, and farthings. To find the shillings, multiply the remainder 53, by 20, the shillings in a pound, and divide again by 109, and so on.

EXAMPLES.

3. What is the discount of 500 dollars, due 2½ years hence, at 6 per cent. per annum? Ans 65D. 21cts. 7m. 45 rem.

If you have paid attention to the rules and examples for illustration; I think you can find the answer of this question.

4. Suppose you purchase a farm for 2000 dollars, for which you give your note, to come due 1 yr. and 3 mo. from the time of purchase; but money coming to hand, you are willing to pay off the note immediately; and the holder of it is willing to allow you 5 per cent. discount for present payment; what will you have to pay down? Ans. 1882D. 35cts. 2m. 10000 rem.

Find the amount of 100 dollars as before; then state it as follows: As the amount thus found is to 100 dollars, so is the given sum 2000 dollars to the present worth.

5. Suppose you buy a quantity of goods on credit, to the value of 350 dolls. for which you give your note, dated Se tember 5th. 1820, *to come due* May 15th. 1821; what will

have to pay down, if the seller allows 5 per cent. discount, for prompt payment? Ans. 338D. 32cts. 1m. 15908 rem.

First, find the time from Sept. 5th. 1820, to May 15th. 1821; then find the amount of 100 dollars for that time, and state it as before.

Observe. Sometimes when a purchase is made on credit, there is an agreement between the seller and buyer, that the payments shall be made, at two or more stated times; thus, perhaps one payment is to be made 6 months from the date; and another 12 months; and to find the discount or present worth of such payments attend to the following:

Note. Find the rebate, or present worth, of each particular payment separately, as before; and when so found, add them into one sum.

6. If a vessel be purchased for 3000 dollars, and the payments to be made as follows: one half at the end of 9 months, and the other half, at the end of 18 months; what is the present worth of said sum, if 6 per cent be allowed the purchaser for present payment? Ans. 2811D. 55cts. 2m. +.

Find the amount of $100 for 9 mo. and state it; placing one half of the $3000 for the 3d. term; and then find the amount of 100 dolls. for 11 mo. and state it again, making the other half of the 3000 dollars the 3d. term; the sum of the present worth of each payment, will be the answer.

7. What difference is there between the interest of 300*l.* at 5 per cent. per annum, for 1½ years, and the discount of the same sum, at the same rate and time?

Ans. 1*l.* 11s. 4d. 3qrs. +.

Find the interest as taught in Simple Interest; then find the rebate, or discount as before; their difference will be the answer.

The above question shows the difference between the discount and the Simple Interest of any sum.

EQUATION OF PAYMENTS.

Equation of Payments, is when several debts are payable at different times; but the debtor and creditor, mutually agreeing that those sums should all be paid at once, and at such a time, as that neither of them may be wronged, or suffer loss thereby; this is called equating the time. The common method of finding such time is by the following:

RULE.

Multiply the sum of each particular payment by its time; add the products together, and divide the sum by the whole debt.

EXAMPLE FOR ILLUSTRATION.

1. Suppose William owed you 800*l.* whereof 200*l.* was to be paid at 3 months, 350*l.* at 6 months, and the rest 250*l.* at 12 months; but you agree that the whole shall be paid at one time, what is the time of payment? Ans. 8 months.

l. m. product.
200 × 3 = 600
350 × 6 = 2800
250 ×12 = 3000
—— ——
800 800)6400(8 mo.
—— 6400
——

For convenience, I have placed the numbers as in the margin with the sign of multiplication, &c. between them; after multiplying them out, I added the products together, and divided by the whole debt, which brought 8 months, the equated time.

EXAMPLES.

2. If A. should buy of B. a quantity of goods, worth 1000D. to be paid in the following manner, viz. 500D. at 2 mo. 250D. at 6 mo. and the rest at the end of 10 mo. but they agree to make one payment of the whole sum; the time of payment is required? Ans. 5 months.

Place this question like the last. Observe, the sum of the first two payments is, 750D. the whole sum 1000, consequently the last must be —— dollars.

3. If a merchant owes you 600*l.* to be paid as follows; 100*l.* at 4 mo. 200*l.* at 6 mo. 200*l.* at 10 mo. and the rest, (100,) at 12 mo. but it is agreed between you, that there shall be but one payment of the whole sum; the equated time is required. Ans. 8 months.

4. Suppose you purchase a house, worth 2000D. and you agree with the seller, that the time of payment should be as follows: $500 down; $1000 at the end of 6 months, and the remainder, $500 at 18 months; but you agree to make but one payment of the whole; what is the time of payment? Ans 7½ months.

First write down the $500 present; then the other payment under it, as before; the 500 is to be added with the others for a divisor.

5. If a debt is to be discharged in the following manner, viz. ½ at 4 mo. ¼ at 8 mo. and the other ¼ at 12 mo. what is the equated time of the whole? Ans 7 months.

You may take any sum that will divide by ½, ¼, &c. without a remainder for this question; take, say 120, then it will be ½ of this, or 60 at 4 months·¼; or —— at 8 months, &c. proceeding as before.

BARTER.

Barter is the exchanging of one commodity for another, and informs us how to proportion the value of any goods, so that neither party may sustain loss. And if the goods or commodity exchanged, are not equal in value, this rule likewise shows how much money will supply that defect.

RULE.

First find the value of that commodity, whose quantity and price are given; then, find how much of the other commodity, at the given price, you can have for the whole of the first mentioned commodity; this quantity will be the answer.

Note. When one has goods at a certain price ready money, but, in bartering, advances it to a higher price; say, as the ready money price of the one, is to its bartering price; so is the ready money price of the other, to its bartering price.

EXAMPLE FOR ILLUSTRATION.

1. What quantity of rye, at 6s. 6d. per bushel, must be given in barter, for 32 yards of broad cloth, at 32s. 6d. per yard?

Ans. 160 bushels.

```
         Yds.      s.    d.       s.   d.   bu.    s.
|6|½|    32   at   32    6   If   6    6  :  1  :: 1040
| | |    32                      12                  12
| | |  ----                      --                ----
         64                      78           78)12480(160 bushels.
        96                                          78
         16                                        ----
       ----                                         468
       1040 shillings.                              468
       ----                                        ----
                                                      0
                                                   ------
```

As the broad cloth was the commodity whose quantity and price were given, I found the value of it by Practice; this come to 1040s; then I stated and worked it by the Rule of Three saying; If 6s. 6d. be 1 bushel, what will 1040s, produce; this brought 160 bushels, the quantity of rye that must be given for the cloth.

EXAMPLES.

a has 135 bushels of wheat, worth 1D.75cts.

per bushel, which he would exchange for corn, at 80 cents per bushel, how much must be given in exchange for the wheat?

Ans. 295B. 1pk. 2qt.

Find what the wheat comes to, then say if 80cts. be 1 bushel, what will the amount of the wheat be, &c.

3. If you have a quantity of rice, worth 5d. per lb. that you would barter for 8C. 2qrs. 17lbs. of sugar, worth 10d. per lb. how much rice must be given for the quantity of sugar mentioned? Ans. 17C. 1qr. 6lb.

Find what the sugar comes to at 10d. per lb. then, make the value of the sugar the third term of the second statement, &c.

4. If, in market, you should come across a quantity of flax, which you wished to purchase, but not having the cash, would barter some wool for the flax; now how much wool at 58cts. per lb. must you give for 5 cwt. of the flax, at 9½cts. per lb?

Ans. 91lb. 11oz. 34 rem.

Find what the flax comes to, and proceed as before.

5. If you had 250 bushel of oats, worth 53cts. per bushel, that you would barter with a lumber merchant for boards, provided he would pay you 45 dollars in money, which he agrees to; how many boards, at 15 cents a piece, must you receive beside the 45 dolls? Ans. 583 boards, 5 rem.

Find what the oats come to, and deduct the cash paid from that sum; then state it, making the remainder the third term.

6. Suppose you have a quantity of shoe thread, worth 4s. per lb. cash; but, being about to barter it away, you value it at 4s. 5d. per lb. the person that you intend dealing with, would give you shoes in exchange for the thread, worth 11s. 6d. per pair, cash; but, in barter, wishes to be upon equal terms with you; be so good as to inform the man the worth of his shoes in barter, in proportion to the bartering price of the thread?

Ans. 12s. 8d. 1qr. 24 rem.

State the question according to the observation given in the rule as follows: as the cash price of the thread is to its bartering price, so is the cash price of the shoes to the bartering price.

7. Suppose you have 70 bushels of salt, worth 5s. 8d. per bushel, which you would give for 28 yds. of cloth; what would the cloth cost you per yard? Ans. 14s. 2d.

Find what the salt comes to, and then say; if 28 yards be that amount what will 1 yard be, &c.

8. If P. sells Q. 720lbs of pork, worth 6½cts. per lb. for which he receives 295lb. of iron worth 5½cts. per lb. and the rest in cash; how much money must he receive?

Ans. he must receive $30.57cts

Find *what the pork comes to*; then find what the iron com

difference will be the answer.

9. Suppose S. has on hand a quantity of indigo, that he sells for 13s. per lb. cash; G. comes in, and asks the price of it, which is told him; he says he will take 45lbs. provided S. will take his pay in brandy, which he is willing to barter away at 10s. 6d. per gallon, although he would sell it at 9s. cash; they bargain; now the question is, how much must the indigo be per lb. in barter, to be upon equal terms; and how much brandy must be given for the indigo?

Ans. The bartering price must be 15s. 2d. and 65 gallons of brandy must be given for the indigo.

Find the bartering price of the indigo; find what the indigo comes to, at the bartering price. To find the quantity of brandy, make the bartering price of the brandy, the 1st. term; the value of the indigo, the 3d. and ——— the 2d.

10. Suppose two men, T. and W. have a mind to barter; T. has 200 bushels of corn, which he would barter away at 5s. 3d. per bushel. W. has 80 bushels of rye, worth 5s. 9d. per bushel, which he would give him in return for the corn; but this being insufficient to balance the corn, W. would give him oats at 3s. 4d. per bushel to make up the deficiency; be so good as to find how many bushels of oats it will take?

Ans 177 bushels.

Find what the corn comes to, (by Practice if you please,) then find what the rye comes to; the difference will be the amount to be given in oats; to find the quantity say, if 3s. 4d. be 1 bushel, what will the amount mentioned, &c. be.

11. Suppose a vessel comes into port with a cargo of wheat, consisting of 1500 bushels; which, in the course of trade, is bartered away, at 1D. 52cts. per bushel, for another cargo, consisting of the following articles; viz. 1200 bushels of salt, at 72 cents per bushel; 12 barrels of sugar, weighing together, 25C. 2qrs. neat, at 11D. 40cts. per C. 12 bales of muslin, each containing 20 pieces, at 2D. 50cts. per piece; and the remainder in coffee, at 21½cts. per lb. the quantity of coffee is required?

Ans 21C. 3qrs. 7lbs. +

Find what the wheat comes to. Find what the salt comes to. Find what the sugar comes to. Find what the muslin comes to; and add what the salt, sugar, and muslin come to into one sum, and deduct that sum from the amount of the wheat; then, to find the quantity of coffee, say, as 21½cts. is to 1lb. so is the remainder found, to the quantity required.

LOSS AND GAIN.

Loss and Gain is an excellent rule; for, by it, the merchant and tradesman discover the gain or loss upon any parcel of goods. It also instructs how to raise, or fall, upon the price of any goods, in such proportion, that the gain may not be more than it ought, nor the loss so as to injure those concerned. By this rule, the merchant discovers his loss or gain per cent., and it likewise instructs how to raise or fall, so as to lose or gain so much per cent.

CASE I.

To find what is gained, or lost, on any quantity of goods.

RULE.

Find by the most expeditious method, (as the Rule of Three, Practice, &c.) the value of the commodity, both for the purchasing and selling price, their difference will be the answer.

EXAMPLE FOR ILLUSTRATION.

1. If I buy 3C. 2qrs. 7lbs. of sugar, at 4£. 8s. 6d. per C. what is the gain upon the whole; if I sold out at 11d. per lb?

Ans. Gained 2*l.* 10s. 5½d.

To find the cost of the sugar.

C.	qrs.	lbs.			*l.*	s.	d.
3	2	7	2	½	4	8	6
							3
					13	5	6
			7	⅛	2	4	3
					0	5	6¼
					15	15	3¼

	l.	s.	d.
Sold for,	18	5	9
Cost,	15	15	3¼
Gain,			

To find what it sold for.

lb.		d.		C.	qrs.	lbs.
1	:	11	::	3	2	7

I found the cost of the sugar by case 10th. Practice, and to find what it sold for, I made a statement by the Rule of Three, and have left it for the learner to work out the process; this will bring what the sugar sold for, viz. 15*l.* 15s. 3¼d. which must be subtracted from the cost of the sugar; the remainder will be the gain.

EXAMPLES.

If I buy a puncheon of rum, containing 104 gallons, for and sell the same for 12½ cts. per pint; what do I gain whole?

Ans. 20 do

Find what the rum comes to, at the selling price. The diff [illegible]*ween this* amount and 84D. the cost, is the answer.

3. Suppose I buy boards for 12½ cts. and sell them for 15 cts. what do I gain on 1500? Ans. $37 50cts.

Deduct the 12½ cts. from the 15 cts. then say, if 1 board be that remainder, what will —— be?

4. Suppose I purchase 5 hhds. of molasses, the whole containing 532 gallons, at 31cts. per gallon; cartage 2 dolls. 50cts. freight 5 dolls. by getting it in store, a head burst, by which accident 17 gallons leaked out; what must I sell the remainder per gal. to gain $45 on the whole? Ans. 42cts. 2m. 90 rem.

Find what the molasses comes to at cost, then add the cartage, freight, and what I would gain to that sum, and state it, making the number of gallons that remain, after deducting what leaked out, the first term, the whole cost the 2nd, and 1 gal. the 3d.

5. If I buy 12C. of sugar, for 4*l.* 16*s.* per C. and sell the same for 13*d.* per lb. do I gain or lose, and how much?

Ans. I gained 15*l.* 4*s.*

Find what the sugar comes to at 4*l.* 16*s.* (Compound Multiplication, if you please,) then, to find what it sold for, say if 1 lb. be 13*d.* &c.

6. If you buy a box of tea containing 82 lbs. for $48.50 cts. and sell the same for $62 25 cts. what do you gain per lb.?

Ans. 16cts. 7m. 56 rem.

The quantity of tea the 1st term, the difference between the buying and selling price the 2nd, &c.

CASE II.

To know how much is gained or lost per cent.

RULE.

First find what the gain or loss is; then say, as the price the commodity cost, is to the gain or loss, so is 100*l.* or 100 dolls. to the gain or loss per cent.

EXAMPLE FOR ILLUSTRATION.

1. Suppose I buy hats for 1*l.* 4*s.* 6*d.* a piece, and sell them for 1*l.* 9*s.* what do I gain per cent. or, in other words, what do I gain by laying out 100*l.*? Ans. 18*l.* 7*s.* 4*d.* 48 rem. per cent.

	l.	*s.*	*d.*
Sold the hats for	1	9	0
Cost	1	4	6
Gain per hat	0	4	6

l.	*s.*	*d.*		*s.*	*d.*		*l.*
1	4	6	:	4	6	::	100
20				12			20
24				54			2000
							12
							24000

As directed in the rule, [illegible] the gain, which was 4*s.* [illegible] then stated it, saying, if 1*l.* 4*s.* 6*d.* cost give 4*s.* 6*d.* gain, what will 400*l.* cost, give for gain [illegible] have reduced the term [illegible] denominations required, [illegible] Rule of Three,) and the [illegible] er may find the result, [illegible] will be 18*l.* 7*s.* 4*d.* the [illegible] on laying out 100*l.*

EXAMPLES.

2. What is the loss per cent. on sugar that is bought at $13 50cts. per C. and sold for $11 90cts. per C? Ans. $11. 85cts. 1m. 1150 rem.

Make what the sugar cost the 1st. term, and the loss the 2d. &c. (To find the loss, deduct the $11 90cts. from the $13 50cts.)

3. If I buy a hogshead of molasses, containing 102 gallons, for $35. 70cts. and sell it out at 41cts. per gallon, what do I gain per cent? Ans. 17D. 14cts. 2m. 3060 rem.

Find what the molasses sold for; then find the difference between the cost and that; when you state it make the cost the 1st. term, &c.

4. Suppose that, by selling goods, you gain 25cts. on a dollar, what per cent is it? Ans. 25 per cent.

Place $1 the 1st. term; the gain the 2d. term, &c.

CASE III.

To know how any commodity must be sold, to gain or lose a certain rate per cent.

RULE.

Say, as 100*l*. or 100D. is to the purchase price, so is 100*l*. or 100D. with the profit added, or loss subtracted, to the selling price.

EXAMPLE FOR ILLUSTRATION.

1. Suppose I buy brandy at 8*s*. 6*d*. per gallon, how must I sell it to gain 15 per cent? Ans. 9*s*. 9*d*. 1qr. 20 rem. per gal.

£
100
15 the gain per cent.

115

	l.		*s*.	*d*.		*l*.
As	100	:	8	6	:	115
			12			
			——			
			102			

According to rule, I added the proposed gain to 100*l*, then stated it, making the purchase price the second term. The learner may take the statement where I have left it, and find the answer, paying strict attention to the rule and manner of working the question. The answer will come in pence, which bring into shillings. From the remainder find the 1qr. &c.

EXAMPLES.

2. If you buy tea for 5*s*. 4*d*. per pound, how must you sell it per lb. to gain 30 per cent? Ans. 6*s*. 11*d*. 20 rem.

Examine the example for illustration.

3. If you buy wine for $1.25cts. per gallon, and, it proving not good as expected, you are under the necessity of losing 20 cent. by it; what must you sell it per gallon, to lose after t rate? Ans. 1 dollar.

The loss must be subtracted from 100, deduct it and make the the third term; the other terms as before.

4. If you buy flour for $6.50cts. per barrel, and keep it on hand till you are obliged to sell it at 15 per cent. loss; what is the selling price per barrel? Ans. $5.52cts. 5m.

5. Suppose I have 2 dozen of superior scythes, that cost 8s. 9d. a piece, which I wish to sell at 15 per cent. advance, but on opening the pack find that 3 of the scythes are entirely unsaleable, what must I sell the remainder for a piece to gain the 15 per cent? Ans. 11s. 6d.

Find what the 2 doz. comes to at 8s. 9d.; then deduct the three unsaleable scythes from the 2 doz. and state it, making the remainder the 1st term; what the whole comes to, the 2d. and 1 scythe the 3d. To find the selling price, state it by the rule, making the 115*l.* the 3d.

CASE IV.

When the gain or loss per cent. is given, to find what the commodity cost.

RULE.

Say as 100*l.* or 100 dolls. with the gain per cent. added, or loss per cent. subtracted, is to the given price, so is 100*l.* or 100 dolls. to the first or prime cost.

EXAMPLE FOR ILLUSTRATION.

1. If I sell coffee at 2s. 3d. per lb. and thereby gain 12½ per cent. what was the first cost? Ans. 2 shillings.

$$\begin{array}{rr l}
l. & s. & \\
100 & 0 & \\
12 & 10 & = 12\tfrac{1}{2}l.\text{ per cent.} \\
\hline
112 & 10 & \\
\hline
\end{array}$$

$$\begin{array}{rrcrrcr}
l. & s. & & s. & d. & & l. \\
112 & 10 & : & 2 & 3 & :: & 100 \\
20 & & & 12 & & & 20 \\
\hline
2250 & & & 27 & & & 2000 \\
\hline
\end{array}$$

In the first place, I added 12*l.* 10s. (which is the 12½ per cent.) to 100, and then stated it, according to rule, making the selling price the second term, &c. The learner, when working out the process, will finish what I have left undone; the result will be 24 pence, or 2 shillings, the cost of the coffee.

EXAMPLES.

2. Suppose that by selling salt at 80 cents per bushel, I gain 15 per cent. what did it cost me? Ans. 69cts. 5m. 75 rem.

Examine the rule and example for illustration.

3. If I sell broad cloth at $4.50cts. per yard, and th
er cent. what did the cloth cost me?
Ans. 5D. 62ct
the loss per cent. from 100, and make the remainder th
ther terms as before.

4. If you sell 15C. 1qr. 19lb. of sugar, at 11½d. per lb. and thereby gain 15½ per cent. what was the prime cost of the whole? Ans. 71*l.* 12s. 11d.

First, find what the whole comes to by the Rule of Three; then state it, making the whole cost the second term. For 15½, you may say 15*l.* 10s.

CASE V.

If, when goods are sold at a certain rate, there be so much gained or lost per cent. to know how much would be gained or lost per cent. if they were sold at another rate.

RULE.

As the first price is to 100*l.* or 100 dolls. with the profit per cent. added, or the loss per cent. subtracted; so is the other price, to the gain or loss per cent. at the other rate.

Observe. If the answer is more than 100*l.* or 100 dollars, the excess, (or what it is more,) is the gain per cent. But if it be less than 100*l.* or 100 dollars, that deficiency is the loss per cent.

EXAMPLE FOR ILLUSTRATION.

1. If you sell wool at 4s. per lb. and thereby gain 12 per cent. what will you gain per cent. if you sell it at 4s. 6d. per lb? Ans. 26 per cent.

l.
100
12 gain per cent.
112

s.		*l.*		s.	d.
4	:	112	::	4	6
12				12	
48				54	

You will see that I have proceeded according to rule. The per cent. was gain, I added it to 100, then stated it, as in the margin. The learner will find, by working the question, the result to be 126*l.* for quotient; as this is more than 100, subtract 100 from it, the remainder will be 26*l.* the gain per cent.

EXAMPLES.

2. Suppose A. sells rum for $1.25cts. per gallon, and thereby gains 20 per cent. what will he gain or lose per cent. if he sells it at $1. per gallon? Ans. He will lose 4 per cent.

Work as in the last example; the quotient will be less than 100, which subtract from 100, the remainder will be the loss per cent.

3. Suppose you sell powder for $12 per cask, and thereby lose 10 per cent. what will you lose or gain per cent. if you sell the same powder at $13 per cask?

Ans. You will lose 2½ per

By the operation, you will get 97D. 50cts. which subtracted fro *leaves 2D. 50cts. or 2½* per cent.

Questions for Exercise in Barter, and Loss and Gain.

1. Suppose I purchase 500 bushels of corn, at 75 cents pe bushel, and then barter it away at 80cts. for wheat; the barte ing price of which is $1.60cts. per bush. and afterwards sell th wheat at $1.90cts. how many bushels of wheat did I get, a what is the gain?

Ans. 250 bush. wheat, and the gain is 100 doll

Find what the corn comes to at 75cts. likewise, at 80cts. then fi how much wheat I can have for what the corn comes to at the last pri after finding that, find what the wheat comes to at the selling price, a the difference between this, and what the corn comes to at the first pri is the gain.

2. Suppose I bought 200 yards of muslin, for 30*l.* with a desi to trade a little; but finding money scarce, I had recourse to b ter, and coming across a chap who had hats, that he valu in the way of trade, at 20s. which he offered to give for t muslin. I told him, that if he would give me 2 hats, over a above what the muslin would come to, I would let him have at 3s. 6d. per yard, and allow him his price for his hats, whi he agreed to; after the bargain, hats took a rise, and I thou of selling off, but being offered only 24s. I waited in hopes getting more, but to my disappointment the price came do and I was obliged to sell at last for 16s. 8d. and glad to that; now, be so good as to tell how matters stand with me; me whether I have gained or lost, and how much—and h much would have been gained or lost by embracing the h est price?

Ans. I gained 0*l.* 16s. 8d. and had I embraced the price, I should have gained 14*l.*

Find what the muslin comes to at 3s. 6d. then find how many could be had for that sum; remember to add the 2 hats given in, t nu r found; find what the hats come to at 16s. 8d. and the differ between that, and the cost of the muslin will be the loss or gain– what the hats come to at 24s. and the difference between that an 30*l.* is what would have been the gain or loss.

3. Suppose M. barters for currant wine at 90cts. per ga giving in return, 60 gallons of rum at 75cts. per gallon; then traded away the wine, at $1 per gallon, for muslin, a cents per yard; which, by good luck, he sold for $60, how m muslin did he get? what did he gain, supposing the first co the rum to have been 65cts. per gallon; likewise, what was

e was 125 yards of muslin, he gained
he gain per cent. was 53D. 84cts. 6m.

Find what the rum comes to at 75cts. find how much wine at 90cts. must be given for that sum; then find what the wine comes to at 1 doll. then find how much muslin must be given for that sum; after which find what the rum comes to at 65cts. and subtract it from what the muslin sold for; this will be the gain; then to find the gain per cent. state it according to rule, under case 2d. loss and gain; making what the rum cost, the first term; the gain the second, and 100 dolls. the third.

4. Suppose T. buys 300 axes, at 7s. 6d. intending, if he sold them, to make 22*l.* 10s. on them; but not finding a ready sale for cash at his price, and meeting with a person that would take them in barter at that rate, giving in return sugar at 4*l.* 10s. per C. he concluded to take it; and, finding sale for one half of the sugar, sold it for 5*l.* per C. cash; then, bartered away the other half at 5*l.* 10s. per C. for coffee, at 2s. 6d. per lb. being taken in with the coffee, he was obliged to sell it for 74*l.* 5s.; now, how stands the account? How many C. of sugar did he get? How much coffee did he get? How much per cent. did he lose upon the coffee; and, upon the whole, how much has he gained or lost by trading?

Ans. He got 30C. of sugar; 660lbs. of coffee; lost 10 per cent. upon the coffee; gained on the whole trade 36*l.* 15s.

Find what the axes come to at 7s. 6d. and add the 22*l.* 10s. to it; then find how much sugar must be given for that amount; find what $\frac{1}{2}$ of the sugar comes to at 5*l.* per C. find what the other half comes to at 5*l.* 10s. find how much coffee at 2s. 6d. per lb. must be given for this last amount; then, to find the loss per cent. on the coffee, subtract the selling price, (74*l.* 5s.) from the cost, (82*l.* 10s.) and state it according to rule, under case 2d. this will bring the rate per cent. then to find what was gained or lost on the whole; add what the $\frac{1}{2}$ of the sugar come to that was sold for cash, and what the coffee sold for together, and from that sum subtract what the axes come to, at 7s. 6d. the remainder is the gain.

FELLOWSHIP.

The rule of Fellowship, is that, by which the accounts of merchants, or other persons, trading in partnership are so adjusted, that each person may have his share of the gain, or sustain his share of the loss, in proportion to his principal, or the money he put in stock. By this rule, a bankrupt's estate may be divided among his creditors, when there is a deficiency w *fects; also legacies* adjusted, &c.

SINGLE FELLOWSHIP.

Is when the several shares of stock or principal are continued in trade an equal term of time.

RULE.

As the sum of all the stocks put in, is to the whole gain or loss; so is each person's particular share in stock, to his particular share of the gain or loss.

PROOF.

Add all the shares of the gain or loss together, and that sum (if right,) will be equal to the whole gain or loss.

EXAMPLES FOR ILLUSTRATION.

1. If three persons, T. W. and C. enter into partnership, and purchase goods to the amount of 1000D. T. puts in 350D. W. 450D. and C. 200D. and by trading they gain 280D. what is each man's share of the gain?

Ans, T's. share is 98D. W's. 126D, and C's. 56D.

	D.	D. stock.		D. gain.		D. stock.	Proof.	D.
T's. stock,	350	as 1000	:	280	::	350	T's. gain is	98
W's.	450			350			W's,	126
C's.	200						C's,	56
	1000			14000 840				280

1(000)98(000(

$98 T's. gain.

D. D. D.
1000 : 280 :: 450
450

14000
1120

1(000)126(000

$ 126 W's. gain.

D, D. D.
1000 : 280 :: 200
200

1(000)56(000

$ 56 C's. gain.

I added the several stocks together, then stated it, to find the first man's gain; saying, as 1000D. stock is to 280D. gain, so is 0D. stock to the first man's share of the gain. I made two more statements, to find the gain of the others; for proof, I added the gain of each into one sum, which amounted to 280 dolls. the whole gain.

The justness of this rule is plain; for if one man puts in ½ of the stock he ought to have ½ of the gain, or to sustain ½ of the loss; or, if he puts in ¼ of the stock, he is entitled to ¼ of the gain, or to bear ¼ of the loss, &c.

EXAMPLES.

2, Two men, M. and O. trade in company; M. puts in 40*l.* O, puts in 30*l.* and they gain 14*l.* what is each man's share of the gain? Ans, M's. is 8*l.* O's, 6*l,*

Read the rule, and you will see that the sum of what M. and O. put in stock, must be the 1st. term of each statement, the gain the 2d. and what M. put in the 3d. of the first statement, and what O. put in the 3d of the second statement.

If it had been so much loss, the statements would have been the same.

3. Suppose three persons, R, S, and T. enter into partnership in trade; the amount each puts in stock as follows: R. puts in $750. S. $580. and T. $370, but being unfortunate, they lose $450. what is each man's share of the loss?

		D,	cts.	m,
Ans.	R's, is	198	52	9 & 700 rem.
	S's,	153	52	9 & 700
	T's.	97	94	1 & 300

The sum of the stocks, the 1st. term of each statement, and what— put in the 3d. of the 1st. statement what—put in the 3d. of the 2d. and what—put in the 3d. of the 3d. statement.

4. Suppose that L, B. and A, freight a vessel from New York to London, with 1500 barrels of flour; of which L. puts on board 600 barrels; B. 543, and A. 357; and, on the passage, the vessel is overtaken by a storm, which occasions the captain to throw overboard 500 barrels; what is each man's part of the loss? Ans. L. lost 200, B. 181, A. 119 barrels.

The whole number of barrels that L. B. and A. put on board, the 1st. term; what was lost, the 2d. what L. put on board, the 3d. of the 1st. statement, &c. then proceed.

5, If 720 be given to be divided into three parts, which shall be to each other, as 4, 6, and 8, what is each part?

Ans. 160, 240, and 320;

The sum of 4. 6, and 8, for the 1st. term; the given sum the second, &c.

6. If K, and D, trade together till they have gained 150*l.* what is the share of each, supposing K. to be entitled to three times as much as D? Ans. K. 112*l.* 10s, and D. 37*l,* 10s,

Suppose D. to have 1£. then K. must have 3£. as he had three times as much the sum of these; the 1st. term the gain, the 2d. &c.

7. Suppose a bankrupt is indebted to N. $245.75cts. to B, $160, to H. $367.50cts. and to U. $97.25cts. and it is found that his whole estate is worth no more than $495.20cts. which is to be divided between said creditors, how much must each have in proportion to his debt?

		$.	cts.	m.	
Ans.	N.	139	79	9	& 37050 rem
	B.	91	01	8	83100
	H.	209	05	9	14050
	U.	55	32	2	39900

Add the debts of N. H. B. and U. together, and proceed as before, making what the bankrupt was worth, the second term.

8. If H. R. and O. trade with a stock of 650 dollars, by which they gain $250, now A's. stock is $280, R's. 200, what is O's. stock, and what is each man's share of the gain?

Ans. O's. stock, was $120. and

	D.	cts.	m.	
H's. share	107	69	2	& 200 rem.
R's.	76	92	3	50
O's.	65	38	4	400

The sum of A's. and R's. stock, deducted from 650, will give O's. go on to state it as before.

9. Suppose a man, by will, leaves to his three children, the following sums of money; viz. to William, 800*l.* to Henry, 700*l.* and to his daughter Mary, 520*l.* but on examining his estate, it was found to be worth no more than 1750*l.* be so good as to shew what each must have of that sum, as it is not enough to pay the legacies?

		£.	s.	d.	qr.	
Ans.	W.	693	1	4	2	& 1080 rem
	H.	606	8	8	2	440
	M.	450	9	10	3	500

The sum of the legacies must be the first term, and the amount of the estate the second, &c.

* * *

COMPOUND FELLOWSHIP.

Or Fellowship with Time.

Compound Fellowship, is when each person's stock, (or what he puts in,) continues an unequal term of time in company; so that a consideration must be made of the time, as well as the

RULE.

Multiply each person's stock, by the time it has continued in trade, then say,

As the sum of the several products,
Is to the gain or loss;
So is each man's particular product,
To his particular share of the gain or loss.

PROOF.

The same as in Single Fellowship.

EXAMPLE FOR ILLUSTRATION.

1 If three merchants, C. B. and K. enter into partnership, and C. puts in $1500 for 6 months, B. $2500 for 8 months, and K. $3100 for 10 months; with this stock they trade, and gain 2400D. what is each man's share of the gain, in proportion to his stock, and the time it was in trade?

	D.		mo.		
C	1500	×	6	=	9000
B	2500	×	8	=	20000
K	3100	×	10	=	31000
					60000

product. D. product.
as 60000 : 2400 :: 9000
9000
6(0000(2160(0000
360 C's. share.

product. D. product.
60000 : 2400 :: 20000
20000
6(0000(4800(0000
800 B's. share.

product. D. product.
60000 : 2400 :: 31000
31000
2400000
7200
6(0000)7440(0000
1240 K's. share.

	D.	
C's. share,	360	Ans.
B's.	800	
K's.	1240	
Proof.	2400	

I multiplied each man's stock and time together, (according to the rule,) and added the products into one sum. I then stated it, saying; as the sum of the products 60000, is to the 2400D. the gain so is the first, (C's.) product 9000, to his share of the gain; the other statements are the same, only the 3d. term is the product of each particular man. For proof, I added each man's share of the gain together.

EXAMPLES.

2. Suppose two merchants, E. and G. trade in company; E. put in 230D. for 4 months, G. 450D. for 8 months, and they have the good luck to gain 220D. what is each man's share of the gain?

Ans. E's. share is 44D. 77cts. 8m. 3440 rem. and G's.
175D. 22cts. 1m. 1080 rem.

Multiply each man's stock and time together, and make the sum of these products the 1st. term in each statement; the gain the 2d. and the particular product of each man, the 3d. term.

3. If three persons, U. Y. and O. enter into partnership to trade, with a capital of 1000 dolls. U. put in 400D. for 4 months, Y. 250D. for 7 months, and O. put in 140 yards of cloth, (as cash for the remaining part of the stock,) for 5 months; and after examining their accounts, find that they have gained 370 dollars. What was O's. stock, and what was his cloth rated at per yard; and what is each man's part of the gain?

Ans. O's. stock was 350 dolls. and his cloth was valued
at 2D. 50cts. per yd. and of the gain, U. must have
116D. 07cts. 8m. 2200 rem. Y. 126D. 96cts. 0m.
4000 rem. and O. 126D. 96cts. 0m. 4000 rem.

Deduct the sum of U's. and Y's. stock from the whole stock; the remainder will be O's. or the worth of his cloth, which to find the price of say, as the number of yds. is to O's. stock, so is 1 yd. to the price of 1 yd. then multiply each man's stock, and time together, and proceed as before.

4. Suppose two men, R. and C. have the misfortune, by trading, to lose 80£. their stocks were as follows: R. had 110£ for 9 months, and C, 240£. for 7 months, what is each man's part of the loss?

Ans. R's. loss must be 29£. 13s. 3d. 0qr. 1080 rem.
and C's. 50£. 6s. 8d. 3qrs. 1590 rem.

Multiply each man's stock and time together, &c.

5. If two men, S. and L. enter into partnership, to trade for
19 S. puts in stock at first 100D. and after 5 months,
)D. more; L. at first put in 750D. and at the end
g in want of money, he took out 300D. at the en

of the 12 months, they found that they had gained 120*D.* what is each man's share of the gain?

Ans. The gain of S. is 33*D.* 87cts. 5m. 6250 rem.
L. is 86*D.* 12cts. 4m. 4200 rem.

S. had 100D. for 12 mo. likewise, 250D. for 7 mo. these multiplied and added together will be S's. product. L. had 750D. for 7 mo. but by taking out 300D. he had only 450D. for the remaining 5 mo. so that multiplying 750 by 7mo. and 450 by 5mo. and adding these together will bring L's. product; then L's. and S's. product added together, will be the first term; the rest as before.

◆

EXCHANGE.

Exchange is a rule, by which merchants and others find what sum of the money of one country, is equal to a given sum of the money of another country, according to the course of exchange.*

For domestic exchange, see Reduction of coin.

FOREIGN EXCHANGE.

Examples of exchange with the following countries, viz. Great Britain, Ireland, France, Spain, Portugal, United Netherlands, Hamburgh, and East Indies,

Exchange is performed mostly by the Rule of Three Direct.

CASE I.

With Great Britain.

A pound sterling of Great Britain, is 4.44cts. Accounts in Great Britain, Ireland, Canada, and Nova Scotia, are kept in pounds shillings and pence, see the table page 37.

EXAMPLES.

1. In 25£. 15s. sterling, how many dollars and cents, the pound sterling being as above. Ans. 114*D.* 33cts.

Performed by the rule of three; saying, as 1£. st. is to 444cts. so is the given sum to the answer.

2. In 350*D.* 50cts. how many pounds sterling?

Ans. 78£. 18s. 9d. 3qrs. 348 rem.

The 444cts. must be the 1st. term. 1£. the 2d. and the given sum the 3d.

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* Note. The *course of* exchange is sometimes above, and sometimes *below par; Observe,* par is equality in value.

CASE II.

With Ireland.

A pound of Ireland, is 4D. 10cts.

EXAMPLES.

1. Suppose a bill of exchange for 210£. 15s. 6d. Irish money to be remitted to America; what is the value of this bill in Federal money? Ans. 864*D*. 17cts. 7m. 120 rem.

Say, if 1£. be 4D. 10cts. what will ——— be.

2. What will a merchant in New York have to pay, in Ireland, for a bill of exchange, given for 600 dollars? Ans. 146£. 6s. 9d. 3qrs. 330 rem.

Make the 410cts. the first term.

CASE III.

With France.

Accounts in France,* are kept in livres sols, and deniers.

12 deniers, make	1 sol,
20 sols	1 livre,
3 livres	1 crown.

A livre of France is 18½ cents.

EXAMPLES.

1. In 350 livres 10 sols, how many dollars and cents, a livre, being 18½cts. or 185 mills? Ans. 64*D*. 84cts. 2m. 10 rem.

Make a livre the 1st. term, the 185 mills the 2d. &c. Reduce the livres into sols.

2. In 150*D*. 25cts. how many livres? Ans. 812liv. 3so. 2den. 170 rem.

The 185 mills the 1st. term, and 1 livre the 2d.

CASE IV.

With Spain.

Accounts in Spain, are kept in piastres, rials, and marvadies.

34 marvadies of plate,	1 rial of plate.
8 rials of plate,	1 piastre or piece of eight.

A rial of plate is 10 cents.

EXAMPLES.

1. In 248 rials, 16 marvadies, how many dollars and cents? Ans. 24*D*. 84cts. 7m. 2 rem.

* The livre, sol, and denier were formerly used exclusively in France; [illegible] ow kept (principally) in francs and centimes; being [illegible] ,) decimally divided.

centimes,	1 decime,
decimes, or 100 centimes,	1 franc.

Let 1 rial be the 1st term, 10cts. the 2d. &c. multiply the marvadies by —— and add in the 16; reduce the first term the same, &c.

2. In 220 dolls. how many rials of plate? Ans. 2200 rials,

Let the 10cts. be the 1st. term, and the given sum the 3d. or divide the cents in 220 dolls. by the cents in a rial.

CASE V.

With Portugal.

Accounts in Portugal, are kept in millreas, and reas.

1000 reas, make a millrea.

A millrea, is 1*D*. 24cts.

EXAMPLES.

1. If a bill of exchange be drawn upon Lisbon, for 7650 millreas, 97 reas; what is the value of the bill in dollars and cents, or Federal money? Ans. 9486*D*. 12cts. 28 rem.

Make the given sum the 3d. term, 1 millrea the 1st. and —— the 2d. multiply the 3d. term by 1000, and add in the reas; reduce the 1st. term to the same name.

Note.—When the reas are less than 100, place a cipher before them, or when less than 10, place two ciphers before them; thus, for the reas in the question, place 097.

2. If a bill of exchange be drawn upon a merchant in New York, for 2740*D*. 25cts. how much is it in millreas, &c.

Ans. 2209 millreas 879 reas and 4 rem.

Place the 124cts. for the 1st. term, 1 millrea the 2d. and —— for the 3d. if there be a remainder multiply by —— the reas in a millrea and divide again.

CASE VI.

With the United Netherlands.

Accounts are here kept in guilders, stivers, groats and pennings.

8 pennings, make	1 groat,
2 groats,	1 stiver,
20 stivers,	1 guilder or florin.

A guilder is 39 cents.

EXAMPLES.

1. Suppose a bill of exchange, for $295.60cts. be drawn upon a merchant in the United Netherlands; what is the value of this bill in guilders and stivers? Ans. 757G. 18st. 38 rem.

Say as 39cts. is to 1 guilder, &c. If there be a remainder multiply it by —— the stivers in a guilder, and divide again.

2. If a merchant, in the United Netherlands, has a bill of exchange for 360 guilders 14 stivers, to be paid by a mer-

chant in Philadelphia; what is the value of this bill in Federal money? Ans. $140.67cts. 3m.

Say, as 1 guilder is to 39cts. so is, &c. Reduce the first and third terms to stivers.

CASE VII.

With Hamburgh.

Accounts in Hamburgh, are kept in marks, sous, and deniers-lubs, and by some rix dollars.

12 deniers-lubs,	make	1 sous-lubs,
16 sous-lubs,		1 mark-lubs,
3 mark-lubs,		1 rix-dollar.

A mark-banco, is 33⅓ cents.

EXAMPLES.

1. What is the value of 460 marks 9 sous in Federal money? Ans. 153*D*. 52cts. 4 rem.

Say, if 1 mark be 33⅓cts. &c. reduce the 1st. and 3d. terms, both into sous by —— then multiply the 33, by 3, and add in the one third; the answer will come in thirds, which divide by 3; to bring them into cents, &c.

2. If $750,25cts. be remitted to Hamburgh, what is the value of the bill in marks and sous? Ans. 2250 marks, 12 sous.

Say, if 33⅓cts. be 1 mark, &c. Reduce the cents in the 1st. term to thirds, as in the last example. Reduce the cents in the 3d. term, to thirds likewise, and proceed; multiply the remainder by 16, the sous in a mark, and divide again.

Note.—This case may be performed thus; divide the marks by 3, to bring them into dollars; and multiply the dollars by 3, to produce the marks.

CASE VIII.

With the East Indies.

A tale of China is 148cts. a pagoda of India is 194cts. a rupee of Bengal is 55½cts. therefore to reduce East India money into Federal money, *Observe.*

Tales of China, multiply	by	148 cents.
Pagodas of India,	by	194
Rupees of Bengal,	by	55½

In this case, a statement by the Rule of Three, is unnecessary.

EXAMPLES.

1. In 255 tales of China, how many dollars and cents. Ans. 377D. 40cts.

ply by the number directed, and point off the dollars and cents fore taught.

2. In 80 pagodas of India, how many dollars and cents.
Ans. 155D. 20cts.

Multiply by 194 cents, the number directed.

3. In 86 rupees of Bengal, how many dollars?
Ans. $47.73cts.

Multiply and take parts for ½, or you may multiply by 555 mills, and point off accordingly.

4. In 377 dollars 40 cents, how many tales of China?
Ans. 255 tales of China.

Divide the cents in the question by ——

ALLIGATION MEDIAL.

Alligation Medial is when the quantities and prices of several commodities are given to find the mean price of the mixture compounded of those things.

RULE.

As the whole composition is to its total value, so is any part of the composition to its mean price.

EXAMPLE FOR ILLUSTRATION.

1. If a merchant mixes 10 gallons of cherry wine, at 7s. 9d. per gallon, with 9 gallons of canary, at 10s. 6d. per. gal. 12 gallons of currant wine, at 7s. 3d. per gal. and 8 gallons of port wine, at 9s. 2d. per gallon; how may he sell this mixture per gallon?
Ans. 8s. 6¼d. and 1 rem.

```
 gal.    d.     d.
  10×  93=  930
   9×126=1134
  12×  87=1044
   8×110=  880  gal.
As.39   :   3988  : 1
                  1
        39)3988(
```

For the 7s. 6d. in the price, I placed 93d. for the 10s. 6d. 126d. &c. setting all the prices down in pence; I then multiplied each quantity by its price; and added the whole quantity together; the sum was 39 gallons. I next added the value of each quantity together, and stated it, making the whole composition the 1st. term, the total value the 2d. and 1 gallon the 3d. When finished, it will bring 8s. 6d. 1qr. and 1 rem, which is the price of 1 gallon of this mixture. The learner may work it out, and see what the result is,

EXAMPLES.

2. Suppose a farmer mixes 20 bushels of rye, at 75cts. per bush, with 40 bush. of corn, at 60cts. per bush, and 30 bush.

oats, at 35cts, per bush. what is the worth of 1 bush. of this mixture? Ans. 55cts.

Place the quantity and price as in the last example; set the first thus:

B. cts.

20×75=1500 **and so on.**

3, If a grocer mix 3C, of sugar, at 75s, per C. with 2C, at 50s. and 1C, at 90s. per C. what is the price of 1C, of this mixture? Ans. 3*l.* 9s. 2d.

C. cts.

Place them as before: 3×75 &c.

Note—If the price of more than 1C. 1 bush, &c. be required, make such number the third term, and proceed as before.

4. If a dealer in tobacco mixes 40lbs, of tobacco, at 1s. 9d, with 16lbs. at 1s, 8d. and 19lbs. at 10d. what is the worth of a pound of this mixture? Ans, 1s, 6d.

You may set the price down in pence, beginning thus: 40lbs. at 21 pence, &c.

5. Suppose a grocer would mix together three sorts of tea, viz. 20lbs. at 5s. with 35lbs. at 8s. and 25lbs. at 4s. what is the value of one pound of this mixture? Ans. 6 shillings.

6. Suppose a goldsmith melts together 12lbs. of silver bullion, of 9oz, fine, 14lbs. of 7oz. fine, and 14lbs. 4oz, fine; what is the quality, or fineness, of this composition? Ans. 6oz. 11pwts

If, after dividing, there be a remainder, bring it into pennyweights, and divide again.

7. If 3lbs. of gold, of 20 carats fine, 2lbs. of 15 carats fine, and 1lb, of alloy to be melted together; what is the quality or fineness of this mass? Ans. 15 carats fine.

Placed thus: 3×20=60, &c. Place the alloy thus: 1×0=

8, Suppose a merchant wishes to mix some rum, as follows: 20 gals. at 10s. per gal, 50 gals. at 6s. and 10 gallons of water, at 0 per gal. what is the value of a gallon of this rum? Ans. 6s. 3d.

Place the question thus:

gal. s. s.
20×10=200
50× 6=300
10× 0= 0

* * *

VULGAR FRACTIONS.

A Fraction, or broken number, is a part or parts of an unit or in esented by two numbers, placed one above

---

whole of any thing.

the other, with a line drawn between them, thus; $\frac{1}{2}$, one half, $\frac{4}{5}$, four fifths, $\frac{18}{27}$, eighteen twenty-sevenths.

The number below the line is called the denominator of the fraction; because it shows how many parts the unit or integer is broken or divided into, and is the divisor in division.

The number above the line, is called the numerator of the fraction; because it shows, or enumerates, how many of those parts are contained in the fraction, and is the remainder after division.

Try to remember which is the numerator, and which the denominator, they are as follows:

$\underline{5}$ numerator,
6 denominator.

This fraction is called five-sixths; and, supposing it to be five-sixths of a yard, the denominator shows the number of parts the yard is to be divided into, and the numerator shows how many such parts are required to be considered.

Vulgar fractions are proper, improper, compound, or mixed.

A *proper fraction* is when the numerator (or upper figure,) is less than the denominator, (or lower figure,) as $\frac{4}{5}$, $\frac{8}{9}$, $\frac{145}{168}$, &c.

An *improper fraction* is when the numerator is greater than the denominator, as $\frac{3}{2}$, $\frac{15}{4}$, $\frac{148}{67}$, &c.

A *compound fraction* is the fraction of a fracti[illegible], and may be known by the word of, between the parts, as $\frac{5}{9}$ of $\frac{9}{10}$, $\frac{3}{7}$ of $\frac{7}{8}$, of $\frac{1}{2}$, &c.

A *mixed number*, or *fraction*, is composed of a whole number and a fraction, as $3\frac{1}{2}$, $15\frac{3}{8}$, $125\frac{13}{15}$, &c.

REDUCTION OF VULGAR FRACTIONS.

CASE I.

To reduce vulgar fractions, having different denominators, to fractions of equal value that shall have one common denominator.

RULE.

Multiply each numerator, (taking them separately,) into all the denominators but its own, and the products will be the new numerators; then multiply all the denominators into one another for a common denominator.

EXAMPLE FOR ILLUSTRATION.

Reduce $\frac{7}{8}$ $\frac{9}{11}$ $\frac{4}{5}$ and $\frac{5}{9}$ to a common denominator.

$$\begin{array}{ccccc}
\frac{7}{8} & \frac{9}{11} & \frac{4}{5} & \frac{5}{9} & \\
\hline
7 & 9 & 4 & 5 & 8 \\
11 & 8 & 8 & 8 & 11 \\
\hline
77 & 72 & 32 & 40 & 88 \\
5 & 5 & 11 & 11 & 5 \\
\hline
385 & 360 & 352 & 440 & 440 \\
9 & 9 & 9 & 5 & 9 \\
\hline
\frac{3465}{3960} & \frac{3240}{3960} & \frac{3168}{3960} & \frac{2200}{3960} & 3960
\end{array}$$

After placing the fractions as in the margin, and drawing a line under the whole, I took 7, the first numerator, and placed it under the fraction to which it belonged; then I multiplied it by all the denominators but its own, the 8, viz. by 11, 5, and 9. I then took the next numerator, the 9, and placed it under the fraction to which it belonged, and multiplied by all the denominators but its own, viz. by 8, 5, and 9, in like manner I proceeded with each numerator; after having found the numerators, I proceeded to find the common denominator, by multiplying all the denominators together, viz. 8, 11, 5, and 9; lastly I placed this denominator under all the numerators, which ended the work.

EXAMPLES.

2. Reduce $\frac{8}{9}$, $\frac{5}{7}$, and $\frac{11}{12}$ to a common denominator.

Ans. $\frac{672}{756}$, $\frac{540}{756}$, and $\frac{693}{756}$.

Examine the example for illustration.

3. Reduce $\frac{2}{5}$. $\frac{3}{7}$, $\frac{2}{9}$, and $\frac{8}{10}$ to a common denominator.

Ans. $\frac{1260}{3150}$ $\frac{1350}{3150}$, $\frac{700}{3150}$, and $\frac{2520}{3150}$.

4. Reduce $\frac{5}{9}$, $\frac{7}{11}$, $\frac{3}{8}$ and $\frac{2}{3}$ to a common denominator.

Ans. $\frac{1320}{2376}$, $\frac{1512}{2376}$, $\frac{891}{2376}$, and $\frac{1584}{2376}$.

CASE II.

To reduce a vulgar fraction to its lowest terms.

RULE.

Divide the greater term, or number, by the less, and that divisor by the remainder following, till nothing remains; the last divisor is the common measure; then divide both parts of the fraction by the last divisor, the quotients will be the fractions required.

Note 1. If the last divisor or remainder, be 1; the given fraction is already in its lowest terms.

2. When the numerator and denominator, both end with ciphers, strike off an equal number from each; and the remaining figures will be a fraction, of the same value, which reduce to its lowest terms.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{270}{486}$ to its lowest terms Ans. $\frac{5}{9}$.

```
270)270/486 (1
    270
    ———
    216)270(1
        216
        ———
         54)216(4
            216
            ———
```

$54|\frac{270}{486} = \frac{5}{9}$

According to rule, I divided the greater number by the less, making the remainder the next divisor, and the last divisor, the next dividend. In this manner I divided, till therewas no remainder; I then divided both parts of the fraction by the last divisor, 54; which brought $\frac{5}{9}$, the answer, which is the same in value as $\frac{270}{486}$.

EXAMPLES.

2. Reduce $\frac{18}{27}$ to its lowest terms. Ans. $\frac{2}{3}$.
3. Reduce $\frac{148}{260}$ to its lowest terms. Ans. $\frac{37}{65}$.
4. Reduce $\frac{28000}{42000}$ to its lowest terms. Ans. $\frac{2}{3}$.

Cut off the ciphers from both numerator and denominator and reduce the $\frac{28}{42}$ to its lowest terms, the answer will be the same in value as the given sum.

CASE III.

To reduce a compound fraction to a single one.

RULE.

Multiply all the numerators together for a new numerator, and all the denominators for a new denominator; then, reduce this new fraction to its lowest terms by case 2d.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{3}{5}$ of $\frac{5}{9}$ of $\frac{7}{8}$ to a single fraction. Ans. $\frac{105}{360} = \frac{7}{24}$.

$$\frac{3}{5} \times \frac{5}{9} \times \frac{7}{8} = \frac{105}{360}$$

```
 105
 ———
105)360(3
    315
    ———
     45)105(2
         90
         ———
         15)45(3
            45
            ——
```

$15|\frac{105}{360} = \frac{7}{24}$

As directed, I multiplied all the numerators together for a new numerator; that is, I multiplied the 3, 5 and 7 together; this produced 105. I then multiplied the denominators, viz. the 5, 9 and 8, for a new denominator, this produced 360; then I reduced the $\frac{105}{360}$ to its lowest terms by the last case, which brought $\frac{7}{24}$, the answer.

EXAMPLES.

2. Reduce $\frac{5}{9}$ of $\frac{7}{8}$ of $\frac{4}{5}$ to a single fraction. Ans. $\frac{7}{18}$.

3. Reduce $\frac{8}{10}$ of $\frac{3}{4}$ of $\frac{5}{9}$ to a single fraction. Ans. $\frac{1}{3}$

NOTE.—If the denominator of any part of the compound fraction be equal to the numerator of another part, they may both be omitted or expunged, and the other parts of fraction, multiplied as directed by the rule; this will produce the answer, but in lower terms.

4. Reduce $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction. Ans. $\frac{3}{10}$.

You may omit the denominator 4, and the numerator 4; the fraction will stand thus, $\dfrac{1}{2} \times \dfrac{3}{5}$ with which proceed as before.

CASE IV.

To reduce whole or mixed numbers to an improper fraction.

RULE.

1. When there is a whole number, and no denominator given, place 1, for its denominator.

2. When the whole number has a denominator given, or assigned, multiply the whole number by the given denominator, and the product will be the numerator to the given denominator.

3. When the whole number has a fraction annexed to it, multiply the whole number by the denominator of the fraction, and, to the product, add the numerator for a new numerator; which place over the denominator of the fraction.

EXAMPLES.

1. Reduce, or make fractions of, 16, 44, and 159.

Ans. $\frac{16}{1}$ $\frac{44}{1}$ $\frac{159}{1}$.

Nothing more is required than to place a unit, or 1, under each whole number, and the work is done.

2. Reduce 42 to a fraction, whose denominator shall be 8.

Ans. $\frac{336}{8}$.

Read the rule part 2. Remember to put 8 for the denominator of the fraction.

3. Reduce $5\frac{3}{8}$ to an improper fraction. Ans. $\frac{43}{8}$.

$$\begin{array}{r} 5\frac{3}{8} \\ 8 \\ \hline 43 \\ \hline 8 \\ \hline \end{array}$$

As this part of the rule may need illustration, I have worked out the question as in the margin. Here, I multiplied the whole number (5,) by the denominator of the fraction, (8,) and added in the numerator (3,) for a new numerator; under this I placed the denominator of the fraction, which brought the answer.

4. Reduce $18\frac{3}{7}$, to an improper fraction. A[illegible]

uce $1742\frac{27}{48}$, to an improper fraction. Ans. $\frac{83643}{48}$.

CASE V.

To reduce an improper fraction to a whole, or mixed number.

RULE.

Divide the numerator by the denominator; the quotient will be the whole number; then, under the remainder, (if any,) place the denominator for the fractional part, and the whole will be in its proper terms.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{2470}{123}$, to its proper terms. Ans. $20\frac{10}{123}$.

$$\begin{array}{l} \frac{2470}{123})2470(20 \\ \quad\;\; 246 \\ \quad\;\; \overline{10} \\ \quad\;\; \overline{123} \\ \quad\;\; \overline{} \end{array}$$

By a careful examination of the rule, and this example, you will find the result of the following questions without much difficulty. This case, proves case 4th.

2. Reduce $\frac{43}{8}$ to its proper terms. Ans. $5\frac{3}{8}$.
3. Reduce $\frac{129}{7}$, to its proper terms. Ans. $18\frac{3}{7}$.
4. Reduce $\frac{83643}{48}$, to its proper terms. Ans. $1742\frac{27}{48}$.

CASE VI.

To reduce fractions of one denomination to another, being greater, yet retaining the same value.

RULE.

Multiply the denominator, by the parts contained in the several denominations between it, and that which you would reduce it to for a new denominator; or reduce the given fraction to a compound one, by placing the several denominations between it, and that which you would reduce it to, fraction wise; and then reduce this compound fraction to a single one by case 3.

EXAMPLE FOR ILLUSTRATION.

1, Reduce $\frac{2}{3}$ of a farthing to the fraction of a pound.

Ans. $\frac{2}{2880}$ of a £.

$$\begin{array}{ccccccccc} \text{far.} & & \text{d.} & & \text{s.} & & \text{£.} & & \\ \frac{2}{3} & \times & \frac{1}{4} & \times & \frac{1}{12} & \times & \frac{1}{20} & = & \frac{2}{2880} \end{array}$$

Performed by the last mentioned method, as follows; I first set down the given fraction, which being part[illegible]rthing; I placed as a fraction the farthings in a penny, [illegible]ence in a shilling, and the shillings in a pound; and then reduced this compound to a single one, by case 3d. this brought, $\frac{2}{2880}$, for answer; or, had it been reduced to its lowest terms, it would have been $\frac{1}{1440}$ of a £.

EXAMPLES.

2. Reduce $\frac{2}{3}$ of a penny to the fraction of a shilling.

Ans. $\frac{2}{36}$.

Placed thus, $\frac{2}{3} \times \frac{1}{12}$

3. Reduce $\frac{1}{3}$ of a farthing to the fraction of a shilling.

Ans. $\frac{1}{144}$ of a shilling.

First the farthings in a penny; then the pence in a shilling.

4. Reduce $\frac{5}{9}$ of a penny wt. to the fraction of a lb. troy.

Ans. $\frac{5}{2160}$ of a lb.

The pennywts. in an ounce, and ounces in a lb.

5. Reduce $\frac{7}{8}$ of a minute to the fraction of a day.

Ans. $\frac{7}{11520}$ of a day.

The minutes in an hour, and hours in a day.

6. Reduce $\frac{2}{7}$ of a pound avoirdupois, to the fraction of a cwt.

Ans. $\frac{2}{784}$ of a C.

The lbs. in a cwt. or the lbs. in a qr. the qrs. in a C.

7. Reduce $\frac{6}{7}$ of a pint of wine to the fraction of a hogshead.

Ans. $\frac{6}{3528}$ of a hhd.

The pints in a quart; the quarts in a gallon; the gallons in a hhd.

CASE VII.

To reduce fractions of one denomination to those of another, being less, yet retaining the same value.

RULE.

Multiply the given numerator by the parts of the denominations between it, and that denomination you would reduce the fraction to, for a new numerator, and place it over the given denominator, and it will give the new fraction, which reduce to its lowest terms by case 2. Or, as in the last case, you may reduce or make the given fraction a compound one, by placing the several denominations between it, and that, which you would reduce it to, in form of an improper fraction; which, reduce to a single one by case 3, and to its lowest terms by case 2.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{2}{2880}$ of a £, to the fraction of a farthing.

Ans. $\frac{2}{3}$ of a penny.

$$\begin{array}{ccccccccc} \text{£.} & & \text{s.} & & \text{d.} & & \text{qr.} & & \\ \frac{2}{2880} & \times & \frac{20}{1} & \times & \frac{12}{1} & \times & \frac{4}{1} & = & \frac{1920}{2880} \end{array}$$

$$192)\frac{192|0}{288|0}(1$$

$$192$$

$$96)192(2$$

$$192$$

$$96|\frac{192}{288} = \frac{2}{3}$$

You will see the manner in which I have placed this question, it is like the last case; only the parts between the denomination given, and that to which it is to be reduced, are reversed; the numerator of this being the denominator of that; and beginning here with the highest instead of the lowest name. After placing it as in the margin, I reduced the compound fraction to a single one, by case 3; and to its lowest terms, by case 2. the result was $\frac{1920}{2880}$ or, when reduced to its lowest terms, $\frac{2}{3}$ for answer. This case, and case 6, prove each other.

EXAMPLES.

2. Reduce $\frac{2}{36}$ of a shilling to the fraction of a penny.

Ans. $\frac{2}{3}$ of a penny.

Placed thus, $\frac{2}{36} \times \frac{12}{1}$ Remember to reduce it to its lowest terms.

3. Reduce $\frac{1}{144}$ of a shilling to the fraction of a farthing.

Ans. $\frac{1}{3}$ of a farthing.

First the pence in a shilling, then the farthings in a penny.

4. Reduce $\frac{5}{2160}$ of a pound troy to the fraction of a pennyweight.

Ans. $\frac{5}{9}$ of a pennywt.

The ounces in a lb. the pennywts. in an ounce.

5. Reduce $\frac{7}{11520}$ of a day to a fraction of a minute.

Ans. $\frac{7}{8}$ of a min

The hours in a day, the minutes in an hour.

6. Reduce $\frac{2}{784}$ of a cwt. to the fraction of a pound.

Ans. $\frac{2}{7}$ of a lb.

The pounds in a cwt. or the qrs. in a C. and the lbs. in a qr.

7. Reduce $\frac{6}{3528}$ of a hogshead of wine to the fraction of a pint.

Ans $\frac{6}{7}$ of a pint.

T[illegible] in a hhd. the qts. in a gal. the pts. in a qt.

CASE VIII.

[illegible]d the proper quantity or value of a fraction in money, weights, measures, &c.

RULE.

Multiply the numerator of the fraction by the known part in the next inferior or lower denomination, and divide the product by the denominator; if there be a remainder reduce it to the next lower denomination, and divide by the denominator as before; and thus proceed to the least denomination, or as far as necessary; the quotients will be the answer.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{2}{9}$ of a pound sterling, to its proper quantity.

Ans. 4s. 5d. 1qr. $\frac{1}{3}$.

```
   2
  20
  —
9)40(4s.
  36
  —
   4
  12
  —
9)48(5d.
  45
  —
   3
   4
  —
9)12(1qr
   9
  —
3) 3/9 = 1/3
```

According to rule, I multiplied by the next inferior or lower denomination to that given; viz. the shillings in a pound, and divided by the denominator; I had 4 remainder, which I multiplied by the next lower denomination, viz. the pence in a shilling; and divided again by the same divisor; I multiplied the next remainder by the farthings in a penny, and divided again; the last remainder was 3, or $\frac{3}{9}$; which is $\frac{1}{3}$ when reduced to its lowest terms; so that $\frac{2}{9}$ of a pound is, 4s. 5d. 1qr. $\frac{1}{3}$.

EXAMPLES.

2. What is the value of $\frac{141}{350}$ of a pound sterling?

Ans. 8s. 0d. 2qrs. $\frac{260}{350} = \frac{26}{35}$.

What is the next lower denomination to pounds? answer shillings; the next, pence; and lastly, farthings; the denominator is the divisor.

3. What is the value of $\frac{3}{8}$ of a shilling? Ans. 4½d.

First the pence in a shilling, &c.

4. Find the the value of $\frac{7}{8}$ of a dollar, N.Y. Ans. 87cts. 5m.

5. Find the value of $\frac{8}{9}$ of 1£. 14s. 6d. Ans. 1£. 10s. 8d,

Performed by Compound Multiplication and Division, multiplying by the 8, and dividing by the 9.

6. Reduce $\frac{4}{7}$ of a ton to its proper quantity.

Ans, 11C, 1q[illegible]

First ——— by the C. in a ton and divide, &c.

7 of a pound troy, to its proper quantity, &c.

Ans. 4oz. 10pwts.

and pennywts. in an oz.

8. Reduce $\frac{4}{7}$ of a lb. avoirdupois to its proper quantity.
Ans. 9oz. 2dr. $\frac{2}{7}$.

The oz. in a pound, &c.

9. What is the value of $\frac{2}{7}$ of a mile?
Ans. 502yds. 2ft. 6in. 2 b. c. $\frac{4}{7}$.

The yds. in a mile   ft. in a yd.   in. in a ft.   b. c. in an in.

10. What is the value $\frac{3}{5}$ of 22A. 1R. 10P?
Ans, 13A. 1R. 22P.

Multiply by the num. and divide by the denom. see ex. 5.

11. Reduce $\frac{2}{5}$ of a yd. to its proper quantity.
Ans. 1ft. 2in. 1 b. c. $\frac{1}{5}$.

The feet in a yd. &c.

12. What is the value of $\frac{2}{5}$ of an acre? Ans. 1R. 24P.

The roods in an acre, the poles in a rood.

13. What is the value of $\frac{6}{7}$ of a yd. of cloth?
Ans. 3qrs. 1na. $\frac{5}{7}$.

The qrs. in a yd. &c.

14. What is the value of $\frac{8}{9}$ of a day? Ans. 21hr. 20min.

The hours in a day, &c.

15. What is the value of $\frac{2}{3}$ of a hhd. of wine? Ans. 42gals.

The gal. in a hhd.

16. Reduce $\frac{4}{7}$ of a month, to its proper quantity?
Ans. 2W. 2D.

The weeks in a mo. the days in a week.

17. Reduce $\frac{7}{8}$ of a cord of wood to its proper quantity?
Ans. 112 feet.

The feet in a cord.

18. Suppose I own $\frac{9}{16}$ of a lot of boards, consisting of 3680 feet, what is my part? Ans. 2070 feet.

19. What is the value of $\frac{5}{9}$ of 1706*D.* 85cts.
Ans. 948*D.* 25cts.

CASE IX.

To reduce money, weights, or measures to fractions.

RULE.

Reduce the given quantity to the lowest name, or denomination mentioned, for a numerator; reduce the integral part to the same name for a denominator; said fraction reduced to its lowest terms will be the answer required.

EXAMPLE FOR ILLUSTRATION.

1. Reduce 4s. 5d. 1qr. $\frac{1}{3}$ to the fraction of a pound.
Ans. $\frac{2}{9}$ of a £.

```
 s.   d.  qr.   s.
 4    5   1⅓    20
12              12
——             ———
53             240
 4               4
——             ———
213            960
  3              3
———            ———
640           2880
———           ————
640)2880(4
    2560
    ————          640
     320(640(2  320|———— = 2/9
         640       2880
         ———
```

As taught in the rule, I reduced the given quantity to the lowest name mentioned, viz. thirds of a farthing. Then I set down 20, the shillings in a pound, for the integral part, and reduced this to the same name with the other for a denominator; then, I placed the denominator under the numerator, and reduced this fraction to its lowest terms which brought $\frac{2}{9}$ of a pound for answer. This case proves case 8.

EXAMPLES.

2. Reduce 8s. 0d. 2qrs. $\frac{26}{35}$ to the fraction of a pound sterling?
Ans. $\frac{141}{350}$ of a £.

Examine the example for illustration.

3. Reduce 4½d to the fraction of a shilling? Ans. $\frac{3}{8}$ of a shil.

Reduce the 4½d. into halfpence; reduce the integral part, or shilling, to the same name, then reduce the fraction to its lowest terms.

4. Reduce 87cts. 5m. to the fraction of a dollar, N.Y.
Ans. $\frac{7}{8}$ of a doll.

Reduce the given sum into mills; reduce the cts. in a doll. into mills; reduce the fraction to its lowest term.

5. What part of 1£. 14s. 6d. is 1£. 10s. 8d.? Ans. $\frac{8}{9}$.

The first to pence, the lowest name mentioned for a denominator; the other to the same name for a numerator, &c.

6. What part of a ton is 11C. 1qr. 20lbs? Ans. $\frac{4}{7}$.

Reduce the given sum to lbs. reduce the C. in a ton to the same name, and proceed.

7. What part of a pound troy is 4oz. 10pwt.? Ans. $\frac{3}{8}$.

Reduce — to the lowest name mentioned then — the oz. in [illegible]und troy, to the same name, and go on as before.

8. What part of a pound avoirdupois is 9oz. 2dr. $\frac{2}{7}$?
Ans. $\frac{4}{7}$ of a lb.

o dr. and the drams, to sevenths, adding in the 2
e the oz. in a pound to the same name, &c.

9. What part of a mile is 502yds. 2ft. 6in. 2b.c. $\frac{4}{7}$? Ans. $\frac{2}{7}$ of a mile.

The yds. &c. into barleycorns, and then into sevenths; then the yds. in a mile to the same name, and go on.

10. What part of 22A. 1R. 10P. is 13A. 1R. 22P.? Ans. $\frac{3}{5}$.

Reduce both to perches; place the perches in the first for the denominator; then reduce the fraction to its lowest term.

11. Reduce 1ft. 2in. 1b.c. $\frac{1}{5}$, to the fraction of a yd. Ans. $\frac{2}{5}$ of a yd.

The given sum to barleycorns; then multiply by 5, and add in the 1 to reduce the b.c. to fifths, reduce the ft. in a yd. to the same name, &c.

12. What part of an acre is 1R. 24P.? Ans. $\frac{2}{5}$ of a acre.

13. What part of a yd. is 3qr. 1na. $\frac{5}{7}$? Ans. $\frac{6}{7}$ of a yd.

Sevenths are the lowest; reduce the qrs. to na. then multiply by 7, and add in the 5; reduce the qrs. in a yd. to the same name, &c.

14. Reduce 21hrs. 20min. to the fraction of a day. Ans. $\frac{8}{9}$ of a day.

15. Reduce 42 gallons of wine to the fraction of a hhd. Ans. $\frac{2}{3}$ of a hhd.

The 42 gal. for the num. the gal. in a hhd. for the denom. and proceed.

16. What part of a month is 2w. 2d.? Ans. $\frac{4}{7}$.

17. What part of a cord is 112 feet? Ans. $\frac{7}{8}$ of a cord.

The given feet for num. the feet in a cord for a denom. &c.

18. If of a lot of boards consisting of 3680 feet, I own 2070 ft. what part of them are mine? Ans. $\frac{9}{16}$.

The 1st mentioned, the denominator; the last, the numerator.

19. What part of 1706D. 85cts. is 948D. 25cts.? Ans. $\frac{5}{9}$.

The cents in the 1st. the denom. the cents in the last the num. &c.

ADDITION OF VULGAR FRACTIONS.

Note 1. To add fractions together, having different denominators.

RULE.

Reduce the given fraction to a common denominator by case 1, Reduction; then, add all the numerators together, under which subscribe the common denominator; and, if it is an improper fraction, reduce it to its proper terms, by case 5, and you have the sum of all the fractions.

Note 2. To add fractions that are mixed numbers.

RULE.

Reduce the fractions to a common denominator, and add them together, as before directed; then add or annex their sum to the whole numbers.

GENERAL RULE.

Reduce compound fractions to single ones, mixed numbers to improper fractions, and all of them to a common denominator; the sum of the numerators, written over the common denominator, will be the sum of the fractions; if it be an improper fraction, reduce it to its proper terms.

EXAMPLE FOR ILLUSTRATION.

1. Add $\frac{5}{9}$, $\frac{3}{8}$, and $\frac{1}{4}$ together. Ans. $1\frac{13}{72}$.

```
 5/9   3/8   1/4
 ---   ---   ---
  5     3     1    9
  8     9     9    8
 ---   ---   ---  ---
  40    27    9   72
   4     4    8    4
 ---   ---   ---  ---
 160   108   72  288
 108
  72
 ---
288)340(1
     288
     ---
      52=13
     ---  --
     288=72
```

As directed, I reduced the fractions to a common denominator by case 1st. Reduction; then added the numerators together, under which I placed the common denominator, it being an improper fraction. I reduced it to its proper terms, this brought $1\frac{52}{288}$, the fractional part of which, reduced to its lowest term, brought $\frac{13}{72}$.

EXAMPLES.

2. Add $\frac{3}{4}$ and $\frac{1}{2}$ together. Ans. $1\frac{2}{8}$ or $1\frac{1}{4}$.

Reduce the fraction to a common denom: and proceed as directed.

3. Add $14\frac{1}{4}$, $5\frac{1}{2}$, and $7\frac{1}{3}$ together. Ans. $27\frac{1}{12}$.

Take the $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{3}$, and add them as before, and then add the 14, 5, and 7, to their amount, or reduce [illegible]ch to an improper fraction, then to a common denominator, and proceed as directed.

4. Add $\frac{1}{9}$ of 20 and $\frac{3}{5}$ of 13 together. Ans. $10\frac{1}{45}$.

Make fractions of the 20 and 14, by placing 1 for a denom. to each; then reduce the $\frac{1}{9}$ of $\frac{20}{1}$ to a single fraction, likewise the $\frac{3}{5}$ of $\frac{13}{1}$, then add them as in the 2d ex.

5. Add $\frac{7}{8}$ and $15\frac{1}{9}$ together. Ans. $16\frac{1}{8}$.

Add the $\frac{7}{8}$ and $\frac{1}{4}$ as before, then add the whole number to it.

6. Add 18, 5, and [illegible] of $\frac{1}{9}$ together. Ans. $23\frac{1}{12}$.

Reduce $\frac{3}{4}$ of $\frac{1}{9}$ to a single fraction, then add the whole numbers; to which annex the fraction, or make fractions of the 18 and 5, and add as before:

7. Add $5\frac{7}{8}$, $7\frac{9}{10}$, and $\frac{3}{7}$ of 15 together. Ans. $20\frac{57}{280}$.

Reduce $\frac{3}{7}$ of $\frac{15}{1}$ to a single fraction; add the fractions as before, to ic sum of the whole numbers, 5 and 7 :

Note 3.—When the fractions are of several denominations, as money, weights, measures, &c.

RULE.

Find the value of each fraction by case 8th Reduction; then add them in their proper terms.

EXAMPLE FOR ILLUSTRATION.

1. Add $\frac{4}{5}$ of a £ to $\frac{2}{7}$ of a shilling. Ans. 16s. 3d. 1qr. $\frac{5}{7}$.

$\frac{4}{5}$	4	$\frac{2}{7}$	2
	20		12
	—		—
	5)80(16		7)24(3d.
	5		21
	—		—
	30		3
	30		4
	—		—
			7)12(1qr.
			7
			—
			$\frac{5}{7}$

	s.	d.	qrs.
$\frac{4}{5}$ of a £=	16	0	0
$\frac{2}{7}$ of a s.=	0	3	$1\frac{5}{7}$
	16	3	$1\frac{5}{7}$
	s.	d.	qr.

If you have paid attention to the rules, you will remember how case 8th Reduction was performed. By that case I found the proper quantity of each, that is, of the $\frac{4}{5}$ of a £ and $\frac{2}{7}$ of a shilling, and then added them together in their proper terms. By a careful examination, you will understand the process so as to work out the following question.

EXAMPLES.

2. Add $\frac{2}{3}$ of a penny to $\frac{1}{8}$ of £. Ans. 2s. 6d. 2qrs. $\frac{2}{3}$.

For the first, the farthings in a penny; the other, the shillings in a *l.* the pence in a shilling, &c. add them together in the proper quantities.

3. Add $\frac{2}{3}$ of a pound avoirdupois, to $\frac{3}{4}$ of an oz.

Ans. 11oz. 6dr. $\frac{2}{3}$.

4. Add $\frac{4}{7}$ of a ton to $\frac{2}{9}$ of a C.

Ans. 11C. 2qrs. 16lbs. 14oz. 3dr. $\frac{5}{9}$.

For the first, the C. in a ton, &c. the other, the qrs. in a C. &c.

5. Add $\frac{7}{10}$ of a mile to $\frac{3}{4}$ of a yd. Ans. 1232yds. 2ft. 3in.

The yds. in a mile, &c. the ft. in a yd: &c.

6. What is the sum of $\frac{2}{3}$ of a day, $\frac{3}{4}$ of an hour, and $\frac{5}{9}$ of a minute? Ans. 16hrs. 45min. 33sec. $\frac{1}{3}$.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the fractions as directed in addition; then subt the *less numerator* from the greater, their difference be a new numerator, under which subscribe or set the common denominator, if it be an improper fraction, reduce it to its proper terms, by case 5.

EXAMPLES FOR ILLUSTRATION.

1 From $6\frac{3}{8}$ take $\frac{2}{7}$ of 9. Ans. $3\frac{45}{56}$.

$$\frac{2}{7} \times \frac{9}{1} = \frac{18}{7}$$

$$\begin{array}{lll} 6\frac{3}{8} & & \\ 8 & & \\ \hline \frac{51}{8} & \frac{18}{7} & \\ \hline 51 & 18 & 8 \\ 7 & 8 & 7 \\ \hline 357 & 144 & 56 \\ 144 & & \\ \hline 213 & & \end{array}$$

$$\frac{213}{56} \quad (213(3\frac{45}{56} \qquad \begin{array}{c} 168 \\ \hline \frac{45}{56} \end{array}$$

I first reduced the $6\frac{3}{8}$, to an improper fraction, and then reduced the $\frac{2}{7}$ of $\frac{9}{1}$, to a single fraction; after this was done, I reduced the $\frac{51}{8}$ and $\frac{18}{7}$, to a common denominator, and subtracted one numerator from the other for a new numerator, under which I placed the common denominator; it being an improper fraction, I reduced it to its proper terms.

2. From $\frac{8}{9}$ take $\frac{2}{5}$. Ans. $\frac{22}{45}$

Reduce the fraction to a common denominator, and then subtract one numerator from the other, under which place the common denominator. If it be an improper fraction, reduce it to its proper terms.

3. From $\frac{2}{3}$of $\frac{8}{9}$ take $\frac{2}{7}$ Ans. $\frac{58}{189}$.

Reduce the first to a single fraction; and then proceed as before.

4. From 21 take $\frac{12}{15}$. Ans. $20\frac{1}{5}$.

Make a fraction of the 21, by placing 1 for its denominator, and work on.

5. From $\frac{1}{4}$ of 42 take $\frac{1}{9}$ of 23. Ans, $7\frac{17}{18}$.

Make fractions of the whole numbers; reduce each part to a single fraction, and with these work as before.

6. From 48 take $\frac{3}{4}$ of $\frac{1}{2}$ of 120. Ans. 3.

Make fractions of the 48 and 120; reduce the $\frac{3}{4}$ of $\frac{1}{2}$, &c. to a single fraction, and so on.

Note. When the fractions are of several denominations, as money, weights, measures, &c.

RULE.

Find the value of each fraction by case 8th. Reduction, then subtract them in their proper terms.

EXAMPLE FOR ILLUSTRATION.

7. From $\frac{7}{8}$ of a pound, take $\frac{2}{7}$ of a penny.

Ans. 17s. 5d. 2qrs. $\frac{6}{7}$.

$\frac{7}{8}$ 7	$\frac{2}{7}$ 4
20	4
8)140(17	7)8(1qr.
8	7
60	$\frac{1}{7}$
56	s. d. qr.
4	$\frac{7}{8}$ of a £ 17 6 0
12	$\frac{2}{7}$ of a d. 0 0 1$\frac{1}{7}$
8)48(6	17 5 2$\frac{6}{7}$
48	s. d. qrs.

By Case 8th, Reduction, I found the proper quantity of $\frac{7}{8}$ of a pound; likewise, the proper quantity of $\frac{2}{7}$ of a penny; and, then, I took the difference between these quantities for the answer. The operation of subtracting the fraction was performed thus: for the $\frac{1}{7}$, I said, 1 seventh from 7 sevenths, leaves 6 sevenths; which I set down, and carried 1 to the farthings, &c.

8. From $\frac{3}{8}$ of a cwt. take $\frac{3}{10}$ of a lb.

Ans. 1qr. 13lb. 11oz. 3dr. $\frac{1}{5}$.

For the first —— the quarters in a C. &c. —— for the other, the oz. in a lb. &c. you will find that there will be $\frac{8}{10}$, or $\frac{4}{5}$ remainder; for this, when you subtract, say, 4 (the num.) from 5 (the denom.) 1 remains, which set down with 5, the same denom. under it, and carry 1 to the next denomination; and, in this manner proceed with any other, taking the numerator from the denominator, and placing the remainder over the denominator given.

9. From $\frac{2}{10}$ of an oz. take $\frac{1}{9}$ pwt. Ans. 3pwt. 21gr. $\frac{1}{3}$.

For the first, the pwts. in an oz. &c. for the other, the gr. in a pwt.

10. From 5$\frac{3}{4}$ weeks, take $\frac{7}{10}$ of a day.

Ans. 5W. 4D. 13hrs. 12min.

Find the proper quantity of $\frac{3}{4}$ of a week; find the proper quantity of $\frac{7}{10}$ of a day; for the first, the days in a week, &c. for the other, the hours in a day, &c. the 5$\frac{3}{4}$ will be 5W. 5D. 6hrs.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

1. Reduce compound fractions to single ones, by case 3. Reduce whole and mixed numbers, to improper fractions, by case 4.

2. Multiply all the numerators together for a new numerator; and all the denominators for a new denominator. If the product is an improper fraction, reduce it to its proper terms, by *case 5.*

EXAMPLE FOR ILLUSTRATION.

1. Multiply $5\frac{3}{8}$ by $2\frac{5}{9}$. Ans. $13\frac{53}{72}$.

$$\begin{array}{lcll}
5\frac{3}{8} & & 2\frac{5}{9} & \\
8 & & 9 & \\
\hline
43 & \times & 23 = 989 & \\
\overline{8} & \times & \overline{9} = 72 &)989(13\frac{53}{72} \\
 & & & 72 \\
 & & & \overline{269} \\
 & & & 216 \\
 & & & \overline{\frac{53}{72}}
\end{array}$$

I reduced the given numbers to improper fractions; then, multiplied the numerators together for a new numerator; and the denominators, for a new denominator; as the product came in an improper fraction, I reduced it to its proper terms.

EXAMPLES.

2. Multiply $\frac{2}{5}$ by $\frac{6}{7}$. Ans. $\frac{12}{35}$.

Multiply the numerators together for a new numerator; and the denominators for a new denominator.

3. Multiply $\frac{2}{3}$ of $\frac{8}{9}$, by $\frac{2}{6}$ of $\frac{3}{10}$. Ans. $\frac{96}{1620}$ or $\frac{8}{135}$.

Reduce the multiplicand and multiplier, both to single fractions, by case 3; then, multiply as before. Reduce the fraction found, to its lowest terms, by case 2.

4. Multiply $\frac{3}{7}$ of 12, by $\frac{2}{5}$. Ans. $2\frac{2}{35}$.

Make a fraction of the whole number, and reduce it to a single fraction; then, as before.

5. Multiply $9\frac{3}{5}$, by $\frac{7}{8}$ of 11. Ans. $92\frac{2}{5}$.

The multiplicand to an improper fraction, the multiplier to a single one; make a fraction of the whole number, and so on.

6. Multiply $\frac{2}{3}$ of $\frac{4}{5}$, by $\frac{1}{9}$ of $\frac{8}{10}$, and this product by $\frac{1}{4}$ of 19. Ans. $\frac{152}{675}$.

Reduce the multiplicand and both the multipliers to single fractions; then, multiply as before.

7. Multiply $\frac{235}{694}$, by $\frac{8}{9}$. Ans. $\frac{940}{3123}$.

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the fractions, if need be, as before directed in multiplication; then, multiply the numerator of the dividend by the denominator of the divisor, for a new numerator; and then multiply the denominator of the dividend, by the numerator of the divisor, for a new denominator.

Or, invert the divisor; that is, put the numerator in the place of the denominator; and the denominator in the place of the numerator, and proceed as in multiplication; the products be the quotients; and if it be an improper fraction, reduce [illegible] terms, as before taught.

EXAMPLE FOR ILLUSTRATION.

1. Divide $3\frac{5}{8}$, by $1\frac{2}{9}$. Ans. $2\frac{85}{88}$.

$$\begin{array}{cc} 3\frac{5}{8} & 1\frac{2}{9} \\ 8 & 9 \\ \hline 29 & 11 \\ \hline 8 & 9 \end{array} \qquad \begin{array}{l} \frac{29}{8} \times \frac{9}{11} = \frac{261}{88} \end{array} \qquad \begin{array}{r} 88)261)2\frac{85}{88} \\ 176 \\ \hline 85 \\ \hline 88 \end{array}$$

I reduced the dividend and divisor both to improper fractions, and then placed them as in multiplication, inverting the divisor, (as per rule,) and multiplying the numerators together for a new numerator, and the denominators for a new denominator; this brought $\frac{261}{88}$ for the quotient; this being an improper fraction, I reduced it to its proper terms; the result was $2\frac{85}{88}$, for answer.

EXAMPLES.

2. Divide $\frac{3}{5}$ by $\frac{1}{9}$. Ans. $5\frac{2}{5}$.

Change the order of $\frac{1}{9}$, the divisor, and proceed as in multiplication.

3. Divide 41 by $\frac{7}{8}$. Ans. $46\frac{6}{7}$,

Make a fraction of the whole number; invert the divisor, and so on.

4. Divide $\frac{2}{5}$ of 28, by $\frac{3}{4}$ of 9. Ans. $1\frac{89}{135}$.

Make fractions of the whole numbers; reduce the dividend and divisor, both to single fractions, and work according to rule.

5. Divide $6\frac{5}{8}$ by $\frac{3}{7}$ of 4. Ans. $3\frac{83}{96}$.

—— the dividend to an improper fraction; —— the divisor to a single one, &c.

6. Divide 33 by 149. Ans, $\frac{33}{149}$.

Make fractions of the whole numbers; invert the divisor, &c.

7. Divide $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{1}{5}$ of 21. Ans. $\frac{27}{224}$.

Reduce the divisor and dividend, both to single fractions, and so on.

SINGLE RULE OF THREE DIRECT, IN VULGAR FRACTIONS.

RULE.

Prepare the fractions, if need be, as before taught; then, state the question as directed in whole numbers, p. 109; and, as in that rule, multiply the second and third terms together, and divide the product by the first; that is, multiply the denominator of the first term by the numerators of the 2d and 3d, for a new numerator; then, multiply the numerator of the 1st term by the denominators of the 2d and 3d, for a new denominator; the product will be the answer required.

Or, Invert the *1st term*, and multiply all three terms together, *as taught in* multiplication; the product will be the answer in the same name with the 2d term, which reduce to its proper quantity, by case 8, Reduction,

EXAMPLE FOR ILLUSTRATION.

1. If $\frac{2}{9}$ of a pound of sugar, cost $\frac{2}{7}$ of a shilling, what will $28\frac{5}{8}$lbs. cost? Ans. 1£ 16s. 9d. 2qrs. $\frac{4}{7}$.

$$\begin{array}{lllll} & & 28\frac{5}{8} & & \\ \text{lb.} & \text{s.} & 8 & & \\ \hline \text{If } \frac{2}{9} : & \frac{2}{7} :: & \frac{229}{8} & & \end{array}$$

$$\frac{9 \times 2 \times 229}{2 \times 7 \times 8} = \frac{4122}{112}\,(4122(2|0(36$$

$$\begin{array}{r} 336 \\ \hline 762 \\ 672 \\ \hline 90 \end{array}$$

I prepared the question, and stated it according to the rule given in whole numbers; then, as directed, I inverted the divisor, and multiplied all three terms together; this bro't $\frac{4122}{112}$; and, as it was an improper fraction, I reduced it to its proper terms; the result was 36, which was shillings, as the 2d term was shillings.

The learner may bring the shillings to pounds, and find the pence and farthings from the 90 remainder.

EXAMPLES.

2. If $3\frac{3}{5}$ yds. of broad cloth cost $18\frac{2}{7}$ dolls. what will $91\frac{1}{4}$ yds. come to at that rate? Ans. 463D. 49cts. $\frac{104}{504}$, or $\frac{13}{63}$.

Reduce each term to an improper fraction, then state the question, making the price the 2d. term; invert the divisor and multiply as directed; if the product is an improper fraction, reduce it to its proper terms, &c.

3. If $\frac{3}{10}$ of a gal. of rum cost 2s. 3d. what is $9\frac{1}{2}$ gals. worth, at that rate? Ans. 3£ 11s. 3d.

Reduce the price to pence, and make a fraction of it; reduce the $9\frac{1}{2}$ to an improper fraction; then state it, making the $\frac{3}{10}$ the first term. The answer will come in pence.

4. If an acre of land be worth $29\frac{3}{5}$ dolls. what is the value of $17\frac{1}{4}$ acres? Ans. $510 60cts.

Reduce the price and acres to improper fractions; then state the question, making $\frac{1}{1}$ acre the first term, and proceed.

5. If $60\frac{1}{2}$ bushels of rye cost $40\frac{2}{3}$D. what is that per bushel? Ans. 67cts. 2m. $\frac{64}{363}$.

Reduce the mixed numbers to improper fractions, then state the question, making $\frac{1}{1}$ bushels the third term.

6. Suppose I buy muslin for 2s. 7½d. per yd. what is the value of $6\frac{3}{4}$ pieces, each containing $9\frac{1}{3}$ yds. at that rate? Ans. 8*l*. 5s. 4d. 2qrs.

Reduce the 2s. 7½d. to pence; then reduçe the pence to an imprope
educe the number of pieces, and the yds. in a piece, to im-
ons, and multiply them together; make the product of these
and $\frac{1}{1}$yds. the 1st. and proceed.

7. Suppose you buy 10 tubs of butter for which you give $56\frac{1}{2}$ dollars, and you sell out 5 tubs, containing $240\frac{3}{4}$lbs. at $15\frac{3}{4}$ cts. per lb. and the other 5 containing $220\frac{1}{4}$lbs. at $14\frac{1}{2}$cts. per lb. how much is the gain? Ans. 13D. 35cts. 4m. $\frac{3}{8}$.

Find what the $240\frac{3}{4}$lbs. come to at $15\frac{3}{4}$cts. making $\frac{1}{1}$ lbs. the first term; then, find what the $220\frac{1}{4}$lbs. comes to at $14\frac{1}{2}$cts. the difference between the sum of these and $56\frac{1}{2}$dolls. will be the answer.

RULE OF THREE INVERSE IN VULGAR FRACTIONS.

RULE.

Prepare the fraction (if necessary,) as before; then, state the question as directed in whole numbers, page 126, and as taught in that rule, multiply the 1st. and 2nd. terms together, and divide the product by the 3d. term; that is, multiply the denominator of the 3d. term, by the numerators of the 1st. and 2d. for a new numerator; then, multiply the numerator of the 3d. term by the denominators of the 1st. and 2d. for a new denominator, which place under the numerator for the anwser. Or,

Invert the third term, and multiply all three terms together, as taught in Multiplication; the product will be the answer, in the same name with the 2d. term, which reduce to its proper quantity by case 8, Reduction.

EXAMPLE FOR ILLUSTRATION.

1. If 12 men, in $9\frac{3}{4}$ days, can frame a house; in how many days can 5 men do the same work? Ans. $23\frac{2}{5}$ days.

$$\begin{array}{l}
\frac{12}{1} : 9\frac{3}{4} :: \frac{5}{1} \\
\quad\ \ 4 \\
\quad\ \ \overline{39} \\
\quad\ \ \overline{\ 4\ }
\end{array}$$

$$\frac{12}{1}\times\frac{39}{4}\times\frac{1}{5}=\frac{468}{20}$$

$$\begin{array}{r}
20)468(23\frac{2}{5} \\
40\phantom{8(23\frac{2}{5}} \\
\overline{68}\phantom{(23\frac{2}{5}} \\
60\phantom{(23\frac{2}{5}} \\
\overline{\ 8}=\frac{2}{5} \\
\overline{20}\phantom{=\frac{2}{5}23}
\end{array}$$

I stated the question by the rule given in whole numbers; and, then, set down the terms, inverting the divisor, and multiplied them as directed, which brought $\frac{468}{20}$ for product; this being an improper fraction, I reduced it to its proper terms; the result was $23\frac{2}{5}$ days for answer.

2. If $5\frac{1}{4}$ yds. of cloth, that is $1\frac{1}{4}$ yds. wide, be sufficient for a suit of clothes, how many yards will it take to make a suit, if the cloth is only $\frac{3}{4}$ wide? Ans. $8\frac{3}{4}$.

Reduce the mixed numbers to improper fractions, then it, making the $\frac{5}{4}$yds. wide the first term, and the $\frac{3}{4}$ wide the third.

3. How much in length that is $9\frac{3}{4}$ inches broad, will make a foot square? Ans. $14\frac{10}{13}$ inches.

Prepare the fraction, then state it, making the inches in a foot (wide,) the 1st. term, and the inches in a foot (broad,) the 2nd. make fractions of them, &c. place the 1st. term thus: $\frac{12}{1}$.

4. How many yards of cloth that is 6s. 2d. per yd. must be given for $30\frac{1}{4}$ yds. at 9s. 4d. per yd.?

Ans. 45yds. 3qrs. $\frac{40}{296}$ or $\frac{5}{37}$.

* * *

DECIMAL FRACTIONS.

A Decimal Fraction is a fraction whose denominator is always an unit, or 1; with one or more ciphers annexed to it.

Thus an unit, or 1, may be imagined to be equally divided into 10 parts, and each of these into 10 more, so that by a continual decimal subdivision, the unit or 1 may be supposed to be divided in 10, 100, 1000, and so on without end, all being equal parts, and are called tenth, hundredth, thousandth, &c. parts of a unit or 1.

In decimal fractions, it is unnecessary to express the figures of the denominator, as they are always 1, with so many ciphers, as there are places or figures in the numerator.

A decimal fraction is distinguished from a whole number by a point called a separatrix thus, .3 stands for $\frac{3}{10}$ (three tenths,) .75 for $\frac{75}{100}$ or $\frac{3}{4}$ .6483 for $\frac{6483}{10000}$ 6483 (ten thousandths,) and a number standing thus, 26.58 is $26\frac{58}{100}$ (26 and 58 hundreths,) 148.06 for $148\frac{6}{100}$ (148 and six hundreths.) and 21.060 for $21\frac{60}{1000}$ (21 and 60 thousandths,) &c. This last may be written 21.06 which is the same in value as 21.060. *Observe.* If the numerator has not so many places of figures as the denominator has ciphers, make up the deficiency by prefixing ciphers thus $\frac{3}{100}$ must be placed .03 (three hundredths,) and $\frac{9}{1000}$ .009 nine thousandths, &c.)

Ciphers at the right hand of a decimal fraction alter not its value, for .6, 60, .600, or .6000 are each of them the same in value as you may hereafter see; but ciphers, at the left hand of a decimal fraction, decreases its value in a tenfold proportion: for .5, is $\frac{5}{10}$ (five tenths,) or ½ .05 is $\frac{5}{100}$ (five hundreths,) 005 $\frac{5}{000}$ (five thousandths,) &c. Decimals, are counted from the left towards the right, and each figure takes its value from the distance it stands from the first or units place of figures. If it be in the first place after the decimal point, or separatrix, it is tenths; in the second, hundreths; in the third, thousandths, &c. decreasing in a ten fold proportion, as in the following

NUMERATION TABLE.

&c.	Millions.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth parts.	Hundreth parts.	Thousandth parts.	Ten thousandth parts.	Hundred thousandth parts.	Millionth parts.	&c.
	7	6	5	4	3	2	1 ,	2	3	4	5	6	7	

Whole Numbers. Decimals.

By this table it may be seen, that whole numbers increase towards the left, from the units place or point of separation in a tenfold proportion; so decimal parts decrease towards the right, from the units place, or point of separation, in a tenfold proportion.

Observe. The magnitude of a decimal fraction compared with another does not depend upon the number of figures it contains, but upon the value of the first, or left hand figure of the decimal; for example, a fraction beginning with any figure less than .9, as .8964, &c. if extended to any number of figures would not be equal to .9.

NOTE.—The point of separation, or separatrix, is called the decimal point. Endeavour to understand the value of the fraction; it will save you much difficulty.

ADDITION OF DECIMALS.

RULE.

Place the given numbers under each other, according to the value of their places, that is, arrange them so that the decimal points may all be in the same column, then add as in addition *of whole numbers; minding to set the point in the sum, exactly under those in the given number.*

EXAMPLE FOR ILLUSTRATION.

Add into one sum the following numbers, viz. 5984.62; 38.46 181,0061; 39.5; 684.83 and .6954.

5984,62
38.469
181,0061
39,5
684.83
•6954
———
6929,1205

Here I placed the numbers, keeping the poin directly under each other; then, added as in whol numbers. In the 1st number of this question, th decimal parts are hundredths; in the 2d. thou sandths; in the 3d. ten thousandths; in the 4th tenths; in the 5th. hundreths; and in the 6th. te thousandths. The amount brought was 6929. and 1205. ten thousandths.

EXAMPLES.

Yards.	Miles.	Leagues.
58.462	1948.32	8948.321
8928.36	1.085	798.101
148,4	160.28	61.002
16.58	,0046	9.
1.6954	51.83	164.12
,768	142.	.3481

5. Add 18.4, 19.25, 650.,19., .384, and 9.2482, together.

6. Add into one sum, four hundred twenty-five, and three tenths; one hundred seventy-three and forty-five hundredths; one hundred ninety-five, and five hundred sixty-seven thousandths, and forty-seven and two tenths. Ans. 841.517.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Place the numbers according to their value, as taught in addition, with the less under the greater; then, subtract as in whole numbers; place the point in the remainder under those in the given number.

EXAMPLE FOR ILLUSTRATION.

From 758.61 yards take 39.94721. Ans. 718.66279.

From 758.61
Take 39.94721
———
Rem. 718.66279

Here, as directed, I placed the numbers, keeping the point, in the less number, under the point in the greater; then, subtracted as in whole numbers; saying, 1 from 10 leaves 9, &c.

EXAMPLES.

	Dollars.	Hours.	Minutes.
From	654.364	17.4869	878.6564
Take	54.3826	1.987	.9812

5. From 69.48, take 8.692. Ans. 60.788
6. From 1493.462, take 993.72 Ans. 499.742
7. From 1, take .000001. Ans. .999999
8. From seven hundred twenty-five and thirty-three hundredths, take one hundred thirty-five and four hundred and twenty-seven thousandths. Ans. 589.903

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in whole numbers, paying no regard to the decimal point, till the product is obtained; then, point off so many figures from the right of the product towards the left, as there are decimal places in the multiplicand and multiplier.

Observe. If there are not so many figures in the product as there are decimal places, supply the deficiency by prefixing ciphers to the left of the product, to make the number equal.

Note.—To multiply decimals by 10, 100, 1000, &c. remove the point in multiplicand so many places to the right, as there are ciphers in the multiplier.

EXAMPLE FOR ILLUSTRATION.

1. Multiply 3895.62 by 12.8 Ans. 49863.936

```
  3895.62
     12.8
 --------
  3116496
 4674744
 --------
49863.936
 --------
```

I placed the question and multiplied as in whole numbers, paying no regard to the decimals till I had obtained the product; then, I counted the decimal places in the multiplicand and multiplier, which together were 3; then, I began on the right hand of the product, and counted off three figures towards the left, and there placed the decimal point; the result was, 49863 and 936 thousandths.

2. Multiply 4.98306by .0084 Ans. .041857704

4.98306
.0084
———
1993224
3986448
———
.041857704
———

Here, I multiplied as before; and after obtaining the product, I counted the decimal places in the multiplicand, and multiplier, which I found to be 9; then,I began on the right of the product, and counting towards the left, found but 8 figures in the product; I prefixed one cipher to the left of the product to make up the 9 places.

EXAMPLES.

3. Multiply 61.94, by 1.35 Ans. 83.619

There are 4 decimal places in the multiplier, and multiplicand; there must be as many in the product.

4. Multiply 84.69, by 87.4 Ans. 7401906

I have left the product for the learner to place the point.

5, Multiply 2491. by 8.7 Ans, 21671.7

6. Multiply 874. by .074 Ans. 64.676

7, Multiply .000724, by .069 Ans. ,000049956

Prefix ciphers to make up the number of decimal places.

8. Multiply 16.95 dollars, by 3.84 Ans. 65.088

9. What will 49.3lbs. of tea come to, at 1.94 dolls. per lb.
Ans. 95.642 or 95D. 64cts. 2m

10. What will 71.5yds. of broad cloth come to, at 4.195 dolls or 4 dolls. 19cts. 5m. per yd?
Ans. 299.9425 or 299D. 94cts. 2.5m

11, Multiply 8.64 by .005 dollars or 5 mills.
Ans. .04320 dolls

12. Multiply .69 by 10. Ans. 6.9

Proceed according to the note given under the rule.

13. Multiply .869 by 100. Ans. 86.9

14. Multiply .869 by 1000: Ans. 869.

DIVISION OF DECIMALS.

RULE.

Divide as in whole numbers; then,to value the quotient or to place the decimal point,

Observe 1. There must be as many decimal places in the divisor and quotient, (together,) as there in the dividend. (alone.) To find which, first, count the number of decimal places in the dividend; then, count the number in the divisor; and, make up what is wanting, to be equal to the number in the dividend. fr [illegible] quotient, beginning to the right, and counting towards

5. If the number of places in the quotient, are not so many as the question or rule requires, the deficiency must be supplied by prefixing ciphers to the left of the quotient.

Note. 1. When the dividend will not contain the divisor, add, or annex as many ciphers to the right of the dividend as you please, so as to make it equal at least to the divisor.

2. If there be a remainder, you may add, or annex, ciphers to the dividend, and divide on; by so doing, the quotient can be obtained to a greater degree of exactness.

3. To divide by 10, 100, 1000, &c. remove the decimal point in the dividend so many places towards the left, as there are ciphers in the divisor.

EXAMPLE FOR ILLUSTRATION.

1. Divide 522.99176, by 498.64 Ans. 1.109

```
498.64(552.99176(1.109
       49864
       ------
        54351
        49864
        ------
         448776
         448776
         ------
```

Here, I divided as in whole numbers; and, after obtaining the quotient, I then proceeded to place the decimal point in its proper place. To do this, I first counted the decimal places in the dividend, which were 5; I then counted the divisor, this contained 2; now there were 3 wanting to make up the number of places in the dividend; these I made up in the quotient, so that the decimal point came 3 figures from the right to the left of the quotient, as in the question.

2. Divide 137.485, by 249.5. Ans. .55104

```
249.5)137.485000(.55104
       12475
       -----
        12735
        12475
        -----
          2600
          2495
          -----
           10500
            9980
           -----
             520
           -----
```

Here, I divided as before; and, as there was a remainder, I added ciphers to the dividend, and continued the divisor to get the quotient more exactly. (see note 2d.) In this example, there were 7 decimal places in the dividend, and 1 in the divisor; consequently I had to take 6 from right to left in the quotient, to make up the number.

EXAMPLES.

3. Divide 469.832, by 20.9 Ans. 22.48

Divide as directed, if at loss where to place the decimal point, refer to the rule.

4. Divide 89.2 by .8654 Ans. 103.07+

Add or annex ciphers till you get the number of figures required; mind where you place the point.

5. Divide 194.5 by 27.4 Ans. 70985+

Place the point in the quotient as directed in the rule.

6. Divide 8.9453 by 9.46 Ans. .94559+
7. Divide .00049262 by .498 Ans. .000989+
8. Divide 8446.62 by .0075 Ans. 1126216.
9. Divide 1. by .694 Ans. 1.4409+

Add ciphers to the dividend, and divide on.

10. Divide $3648.248 by 34.82 Ans. 104.77
11. Suppose 37.5yds of cloth cost $45, what is the worth of 1 yd.? Ans. 1.2 dolls. or 1D. 20

Divide the 45. by 3.75

12. Divide 8954. by 10. Ans 8954

See note 3.

13. Divide 8954. by 100. Ans. 89.54
14. Divide 8954. by 1000. Ans. 8.954

REDUCTION OF DECIMALS.

CASE I.

To reduce a vulgar fraction to a decimal.

RULE.

Add, or annex ciphers, to the numerator, and divide by the denominator; the quotient will be the decimal fraction required.

NOTE.—Place the decimal point to the right of the dividend. Wh the division is ended, point off the quotient, as taught in division.

EXAMPLE FOR ILLUSTRATION.

1. Reduce $\frac{7}{8}$ to a decimal. Ans. 8

```
7
—
8)7.000(.875
  64
———————
   60
   56
```

As directed, I placed a point to the right the dividend; then, added a cipher and divide by the denominator, continuing so to do till I found the result, which, (after placing the poi by rule,) was .875 thousands, the same in valu as $\frac{7}{8}$.

EXAMPLES.

2. Reduce $\frac{3}{4}$ to a decimal. Ans. .75

$\overset{3}{4}$)3.0(7 and proceed.

3. Reduce $\frac{1}{2}$ to a decimal. Ans. .5
4. Reduce $\frac{1}{4}$ to a decimal. Ans. .25
5. Reduce $\frac{78}{155}$ to a decimal. Ans. .503225 +
6. What decimal is equal to $\frac{5}{9}$. Ans. .5555 +
7. Reduce $\frac{7}{1968}$ to a decimal. Ans. ,0035569 +
8. Reduce $\frac{7}{8}$ of $\frac{9}{10}$ to a decimal. Ans. .7875

Reduce $\frac{7}{8}$ of $\frac{9}{10}$ to a single fraction, and proceed as before.

CASE II.

To reduce money, weights, measures, &c. to the decimal of any given denomination.

RULE I.

Reduce the given money, weights, measures, &c. to the lowest denomination mentioned, for a numerator or dividend; then, reduce the integral part to the same name for a denominator, or divisor; reduce this fraction to a decimal, by case 1st. the result will be the decimal required.

RULE II.

Place the several denominations given under each other, beginning with the lowest, and ending with the highest; then, divide each of them, (commencing at the top,) by its value in the next denomination, annexing the quotient to the succeeding number, (if any,) the last quotient will be the decimal required.

EXAMPLE FOR ILLUSTRATION.

1. Reduce 15s. 9d. 2qrs. to the decimal of a pound sterling. Ans. .78958

```
             s.  d. qrs.
 £.          15  9  2
 1           12
 20         ----
----        189
 20           4
  12        ----
----        758
 240        ----
   4      960)758.00000(.78758
----.          6720        Decimal.
 960          -----
----           8600
By Rule 2.     7680
  4| 2.0      -----
   |------      9200
 12| 9.5000     8640
   |------     -----
 20|15.7916     5600
   |------      4800
     .78958    -----
    ------      8000
                7680
               -----
                 320
               -----
```

I first reduced the given sum to the lowest name mentioned, for a numerator, or dividend; then I reduced the pound to the same name for a denominator, or divisor; this fraction, I reduced to a decimal by the last case, minding to place the point in its proper place.

By Rule 2. As directed, I placed the denominations under each other, beginning with the farthings; then I divided by 4, the farthings in a penny; 12, the pence in a shilling; and 20, the shillings in a pound: this brought the same decimal as the first method, and is much shorter. The learner may work by either.

EXAMPLES.

2. Reduce 7s. 9d. to the decimal of a pound. Ans. .3875

Reduce the 7s. 9d. into pence, and the pound into pence, and proceed as before; or by Rule 2, place the shillings under the pence; and divide by 12 and 20.

3. Reduce 5s. to the decimal of a pound. Ans. .25

The given sum for a num. and the shillings in a £. for a denom. &c.

4. Reduce 5s. $6\frac{3}{4}$d. to the decimal of a pound. Ans. .278125

The farthings in the given sum for the num. the farthings in a £. for a denom. Or by Rule 2, place the farthings, pence and shillings as directed, and divide.

Reduce 19£. 10s. $6\frac{1}{4}$d. to a decimal. Ans. £.19.5260416+

Find the decimal of 10s. 6¼d. as before, then prefix the 19£. to it.

6. Reduce 75 cents to the decimal of a dollar. Ans. .75

The given number of cents the num. and the cents in a dollar the denominator.

NOTE.—When there are shillings only, divide by 2, and place the decimal point to the left of the quotient; the result will be the decimal required.

7. Reduce 18 shillings and 19 shillings to the decimal of a pound. Ans. .9 and .95

You may divide by 2, add a cipher when you divide the 19.

8. Reduce 20 grains to the decimal of a pound, troy. Ans. .003472 +

The given number of grains for a numerator, and reduce a pound to grains, for a denominator, and proceed on as before.

9. Reduce 12 drams to the decimal of a pound avoirdupois. Ans. .046875

Reduce the pound to drams for a denominator, &c.

10. Reduce 2qr. 21lb. to the decimal of a C. Ans. .6875

The lbs. in the given sum for a num. and the lbs. in a C. for a denom.

11. Reduce 5 inches to the decimal of a foot. Ans. .41666+

The inches in a foot will be the denominator; or, work by rule 2.

12. Reduce 45 yds. to the decimal of a mile. Ans. .025568 +

The yards in a mile, for the denominator.

13. Reduce 1 foot 9 inches to the decimal of a yard. Ans. .58333 +

By Rule 2, placed thus, 12|9.
3|1.

14, Reduce 21 gallons of wine to the decimal of a hhd. Ans. .33333 +

The gal. in hhd. of wine for denom.

15. Reduce 20 perches to the decimal of an acre. Ans. .125

16. Reduce 3 calendar months to the decimal of a year. Ans. .25

17. Reduce 4 days to the decimal of a week. Ans. .571428 +

18. Reduce 48 days to the decimal of a year, allowing the year to contain 365¼ days. Ans. .1314168 +

Reduce the ¼ to a decimal, annex it to the 365, for a denom.

19. Reduce 3¼ calendar months to the decimal of a year. Ans. .270833 +

Reduce the ¼ to a decimal, and annex it to the 3 mo. &c.

CASE III.

To find the value of any decimal fraction in money, weights, measures, &c.

RULE.

Multiply the given decimal by the number of parts in the next inferior denomination, and point off so many places or figures for decimals, from the right hand, as the given decimal consists of; then, multiply the remainder by the next inferior denomination, and point off as before; thus proceed, till you have brought the question into the least part of the integer; the several denominations standing to the left hand will be the answer.

EXAMPLE FOR ILLUSTRATION.

1. What is the value, or proper quantity of .9684 of a pound sterling? Ans. 19s. 4d. 1.664qrs.

£.
.9684
20
s. 19.3680
12
d. 4.4160
4
qr. 1.6640

The question being the decimal of a pound, I multiplied by 20, the shillings in a pound; then, pointed off according to rule, and multiplied by 12, the pence in a shilling; pointing off as before; then, by 4, the farthings in a penny; so that .9684 of a £. is equal to 19s. 4d. 1qr. and .664 (thousands) of a farthing remainder.

EXAMPLES.

2. What is the value of .563 of a £ sterling?
Ans. 11s. 3.12d.

The shillings in a pound, &c. there will be 3 figures to point off.

3. What is the proper quantity of .89 of a shilling?
Ans, 10s. 2.72d.

The pence in a shilling, &c. place the point by rule.

4. What is the value of .0548 of a £.? Ans. 1s. 1.152d.

5. What is the proper quantity of .898 of a dollar, N. Y.?
Ans. 89cts, 8m.

The cents in a dollar, &c.

6. What is the proper quantity of .658 of a cwt.?
Ans. 2qrs. 17lbs, 11oz. 2.176dr.

The qrs. in a C. lbs. in a qr. &c.

7. What is the value of .79 of a pound troy?
Ans. 9oz. 9pwts. 14.4gr.

The ounces in a pound troy, &c.

8. What is the value of .162 of a yard? Ans. 2.592na.

ers in a yard, &c.

9. What is the proper quantity of .598 of a mile?
Ans. 4 Fur. 31po. 1yd. 2ft. 11.28in.

The furlongs in a mile, &c.

10. What is the proper quantity of .64 of a yd.?
Ans. 2 qrs. 2.24na.

11. What is the value of .7 of a foot? Ans. 8in. 1.2 b. c.

12. What is the proper quantity of .485 of an acre?
Ans. 1R. 37.6P.

13. What is the value of .89 of a hhd. of wine?
Ans. 56.07gal,

The gallons in a hhd. of wine.

14. What is the value of .078 of a chaldron of coal?
Ans. 2B. 3.232 pks.

15. What is the proper quantity of .084 of a day?
Ans. 2H. 0m. 57.6sec.

16. What is the proper quantity of .004 of a year, allowing the year to contain 365¼ days? Ans. 16D. 1H. 42min. 14.4sec.

The days in a year, &c. Mind and reduce the ¼ to a decimal, and annex it to the 365.

Note.—Addition and subtraction of decimals of different denominations, may easily be performed, after the decimals are reduced to their proper quantities.

EXAMPLES.

17. What is the sum of .323 of a £. .41 of a shilling, and .6 of a penny?
Ans. 6s. 11d. 0.16qrs.

```
  £          s.        d.                      s.  d.   qr.
 .323        41        6   .323 of a £.  6   5    2.08
   20         12       4   .41  of a s.  0   4    3.68
 ----       ----      --   .6   of a d.  0   0    2.40
s 6.460   d 4.92  qr 24                 -------------
    12         4                         6  11    0.16
 -----      ----                         s.  d.   qr.
d 5,520  qr 3.68
     4      ----
 -----
qr 2,080
 -----
```

Here, I reduced each decimal to its proper quantity, as before taught; and then, added them together.

18. What is the sum of .293 of a £, and .94 of a shilling?
Ans. 6s. 9d. 2.4qrs.

Reduce each to its proper quantity; then, add them together.

19. What is the difference between .894 of a £ and .641 of a shilling? Ans. 17s. 2d. 3.472qr

Find their value, then deduct the less from the greater.

20. What is the difference between .094 of a £ and .94 of a farthing? Ans. 1s. 10d. 1.3qrs.

THE SINGLE RULE OF THREE DIRECT IN DECIMALS.

RULE.

If there are vulgar fractions in the question, reduce them to decimals; and, then, state and work the question, as taught in whole numbers, p. 109; when performing the operation, particular attention must be paid to the right placing of the decimal points; otherwise, the true result will not be found.

EXAMPLE FOR ILLUSTRATION.

1. If 1.5lb. of sugar, cost 1s. 6.4d. what cost 2C. 1qr. 14.26? Ans. 13£ 2s. 2.12d.

```
lb.   s.  d.     C. qrs. lbs.
1.5   1 : 6.4 ::  2  1  14.26
      12          4
      ----        -
      18.4        9
                 28
               ------
               266.26
                 18.4
               ------
```

Having stated the question, as directed, I reduced the 3d term to lbs. and annexed the .26 (hundredths) of a pound to the product: then, I reduced the 2d term to pence, and annexed the .4 (tenths) to them. Here, I left the question for the learner to work out. Observe, the product of the 2d and 3d terms will be 4899.184, this must be divided by 1.5, the first term: the quotient will be 3266.12; this, according to rule, is pence; which bring into pounds. Note, when dividing by 12 there will be 2 pence remainder, to which the decimal 12 must be annexed; and so on.

EXAMPLES.

2. If 1 gallon of molasses cost 2s. 6.4d. what cost 48.3 gallons at that rate? Ans. 6£. 2s. 4d. 1.28qrs.

The 48.3 gal. the 3d. term; bring the 2s. to pence, and annex the decimal .4, then proceed; place the decimal point in its proper place; observe, multiply the decimal of the pence, 32 by 4, to bring the farthings.

3. Suppose 3½lbs. of sugar cost .75 dollars, what is the worth of 1cwt. at that rate? Ans. 24 dolls.

The 1C. must be the 3d. term; reduce the ½ to a decimal, and annex it to the 3lb. and go on; remember the decimal point.

4. If 14¾ yds. cost 35.76 dolls. what will ¾ of a yd. cost?
Ans. 1.818+D. or 1D. 81cts.8m.+

—— both ¾ to a decimal, and annex one to 14, make the decimal of the ¾ of a yd. the 3d. term.

5. Su[illegible] uy a hogshead of honey, containing 96.5 gallons, f [illegible] llon; what does it come to?
Ans. 56.935D. or 56D. 93cts 5m.

[illegible] 3d. term.

6. If 12½C. of sugar be bought for 9.75 dolls. per C. what is the gain or loss, if sold for 12.5cts. per lb.?

Ans. 53D. 12cts. 5m.

Reduce the ½ to a decimal; annex it to the 12C. for the 3d. term; after finding the cost of the sugar, state it again, making 12.5cts. the 2d. term, 1 lb. the 1st. &c.

7. If 500½ bushels of flax seed be bought for 628.50 dollars, and then put up into casks, containing 7 bushels each; how many casks are there, and how much is the gain, if sold at 12.61 dolls. per cask, deducting for the cost of the casks $.90 each?

Ans. 71.5 casks, and the gain $208.76cts. 5m.

The ½ as before; bushels divided by 7, will give the casks, then deduct the .90 dolls. from the price the seed was sold for, per cask, and find what the whole comes to; the difference between this and the cost will be the gain.

8. If I buy 3 puncheons of rum, containing as follows—104.5; 97.4; 92.6 gallons; what does the whole come to, at 6s. 6.4d. per gallon? Ans. 96£. 4s, 0d. 3.2qrs.

The whole number of gallons the 3d term.

9. What is the value of 6¾ pieces of muslin, each containing 20.7 yds. at .24 dolls. per yd.? Ans. 33D. 53cts. 4m.

The number of pieces, each so many yards, the 3d. term.

10. Suppose a person owes 3576.25 dolls. and his property is found to be worth only 1945.48 dolls. what can he pay upon a dollar? Ans. .544 of a doll. or 54cts. 4m.

The debt the 1st. and 1 doll. the 3d. term, place the point right.

11. Suppose a man owes W. 645.62 dolls. M. 297.21 dolls. and B. 169.84 dolls. and his property is found to be worth 795.75 dolls. what can he pay upon the dollar?

Ans. .715+of a dollar.

The sum of the debts the first term.

Note.—To find each man's share of a debtor's property, you have only to multiply each debt by what a dollar will pay, as found in the last example; the product will be his proportion. By this method, the estate of a bankrupt can be divided among his creditors, without the tedious operation as in fellowship; likewise, the taxes of a town, &c. can be apportioned by this method, and it may be called a short method of performing Fellowship.

INVOLUTION OR THE RAISING OF POWERS.

Involution, &c. is the multiplying any number by itself, and that product by the same number, and so on. The several products are called powers, for example:

$3\times3=9$ the 2d. power, or square of 3.

$3\times3\times3=27$ the 3d. power, or cube of 3.

$3\times3\times3\times3=81$ *the* 4th. power, or biquadrate of 3, &c.

EXAMPLES.

What is the square* of 84? Ans. 7056

Multiply 84 by 84.

What is the cube of 38.4? Ans. 56623.104

Multiply 38.4 by 38.4 and that product by 38.4.

What is the biquadrate of 24? Ans. 331776

24×24×24×24.

EVOLUTION, OR THE EXTRACTING OF ROOTS.

Evolution, &c. is the reverse of Involution; it is finding the root of any number or power, which, by a continual multiplication into itself, will produce that power; for example; 9 is the square root of 81; because 9 multiplied by 9, produce, 81; and 3 is the cube root of 27, because 3×3×3=81, &c.

EXTRACTION OF THE SQUARE ROOT.

The extraction of the square root is the finding of such a number as, being multiplied by itself, the product will be equal to the given number; thus, the square root of 64 is 8, consequently, 8 times 8 are 64, as in the following table:

Roots.	1	2	3	4	5	6	7	8	9
Squares.	1	4	9	16	25	36	49	64	81

By this table, you will see the root and square of any number from 1 to 9.

RULE.

1. Point off the given number into periods of two figures each, beginning at the units place; placing a point or dot over the units place, and another over the place of hundreds; and so on, placing a point over every second figure. If there be decimals, point them off, in the same manner, from the decimal point towards the right hand, placing the first point or dot over the second figure from the decimal point; and likewise, over every second figure, to the end; and if there be an odd figure add a cipher to make up the period.

2. Find by the table, or your own judgment, the greatest square number that is contained in the first or left hand period, placing the root of it as a quotient, and likewise as a divisor; then, place the square of the number under the first period, and subtract it from said period; and, to the remainder, bring down the next period, or two figures, for a dividend.

---

of a number is the product arising from its being mu-

3. Double the quotient or root, and place it for a divisor, on the left hand of the dividend; here, judge how often the divisor, (allowing one figure more to stand to the right of the divisor,) is contained in the dividend; set the number thus found in the place of the quotient, as in common division; and also, on the right of the divisor, (where you made allowance for a figure to stand,) multiply the divisor by this last quotient figure, placing the product under the dividend; and then, subtract it from said dividend; and to the remainder bring down the next period (or two figures;) proceed to double the figures found in the root, and thus continue the operation till you have brought down all the periods.

Note 1.—If the given number be not a perfect square, there will be a remainder after all the periods are brought down; in that case, you may add (two) ciphers to make up the period, and bring them down as before; and thus continue the operation till you get the answer or as many figures as are necessary.

2. To place the decimal point, observe: There must be as many figures to the right and left of the decimal point in the root found, as there were periods to the right and left of the decimal point in the given number.

EXAMPLE FOR ILLUSTRATION.

1. What is the square root of 245025? Ans. 495

```
   4)245025(495.
     16
     ---
   89)850
      801
     ----
  985)4925
      4925
      ----
         0
```

As directed in the rule, I pointed off the given number into periods of two figures each, and then sought the greatest square number contained in 24, the left hand period, which I found to be 4,(for 5 times 5 are 25,) which is more than 24, the given number. I placed the 4 as a quotient, and likewise as a divisor, and multiplied it, placing the product 16, under the 24; then I subtracted the 16 from 24; and, to the remainder, brought down the next period 50, annexing it to it for a dividend; I next doubled the last root 4, placing it beside the dividend, and sought how often this number (allowing a figure to stand at the right of it) would go into 850, which being 9 times, I set this beside the root last found, and likewise to the right of the divisor, (where I made allowance for a figure to stand) which made 89 for a divisor; I then multiplied this by 9, the last figure in the root, and placed the product under the 850; this produced 801, which I subtracted from the 850, and to the remainder brought down the next period 25, which made the next dividend 4925. I doubled the root again, that is, the 49, placing it beside the dividend, and sought how often this divisor (allowing a figure to stand to the right, as before) would go into the dividend, which I found to be 5 times; this I set in the place of the quotient, and likewise to the right of the dividend, and multiplied it by the root last found, the product of which I put under the last dividend; here I had 0 remainder, which showed that the given number was a perfect square. To prove this question, multiply the root 495 by 495, that is, square it, and you will have the given number.

EXAMPLES.

2. What is the square root of 84651.632 Ans. 290.949

$2)\dot{8}4\dot{6}5\dot{1}.6\dot{3}2\dot{0}(2909$
4

49)446
441

5809)55163

When I pointed off the question, I added 0, to make up the period. You will see how I proceeded when it went 0 times: I placed an 0 with the root found, and likewise to the right of the divisor, and then brought down another period; the learner will proceed with the question as directed in the rule till the result is obtained; to find the last figure, add two ciphers, to make a period, and work on.

3. What is the square root of 427716? Ans. 654

$6)\dot{4}2\dot{7}7\dot{1}6(65$
36

125)677

Proceed according to rule.

4. What is the square root of 18671041? Ans. 4321

$4)\dot{1}8\dot{6}7\dot{1}0\dot{4}1(4$
16

)267

Double the root last found, aad place it beside the dividend, &c.

5. What is the square root of 974169? Ans. 987
6. What is the square root of 395672? Ans. 629 and 31rem.
7. What is the square root of 384·927? Ans. 19.61 & 3749 r.

$4)\dot{3}8\dot{4}.9\dot{2}7\dot{0}(1$ I added a cipher, to make up the last period.

8. What is the square root of 3? Ans. 1.732 and 176 rem. Add ciphers till you get the answer.

What is the square root of .000643?
Ans. .02535 and 3775 rem.

2).000643(2 Place the decimal point in its proper place; attend to
4 Note 2, after the rule.

10. What is the square root of 4016016? Ans. 2004

APPLICATION.

11. What is the mean proportional between 3 and 12? Ans. 6

Multiply the two numbers together, and extract the square root of the product.

12. If the content of a circle be 4761 rods; what is the side of a square, whose superficial content shall be equal thereto? Ans, 69 rods

Extract the square root of the given content.

13. Suppose I have a garden, in an oval form, containing 2A. 3R. 16P. and wish to make a square one of the same content; how many rods must the length of a side be? Ans. 21.354 rods, 6684 rem.

Bring the acres into perches, and extract the square root of them.

14. What is the diameter of a circle, whose content is 2 acres, or 320 rods of ground? Ans. 20.18+

Say, as 355 is to 452 so is the given content to the square of the diameter; extract the square root of the result for the answer.

15. Suppose a house known to be 30 feet high, stands upon the opposite side of a river or stream, 48 feet wide, how many feet is it from the opposite side of the stream to the top of the house? Ans. 56 feet, 7.2 in.

Square the width of the stream; square the height of the house; add the products together, and extract the square root of their sum.

16. If a ladder 44 feet long, be so placed as just to reach the top of a house, while the foot of the ladder is 29 feet from the foundation, how high is the house? Ans, 33.09 feet, 519 rem.

Square the length of the ladder; square the distance from the foundation; then, extract the square root of the difference between the two products.

17. Suppose a flag staff, whose height is unknown, be broken by a gust of wind somewhere near the middle, which by its fall broke the ground 26 feet from the foot of the pole or staff, and the broken pieces found, (by measuring) to be 47 feet; how long is the flag staff? Ans. 86.15 feet+

Square the 47; square the 26; then, extract the square root of the difference of their products; the result will be the standing part, which added to the length of the broken part, will be the answer.

18. If two vessels sail from the same place, and one sails due south 45 miles, and the other due east 54 miles, how far are they apart? Ans. 70.29 miles.

Done like the 5th example.

19. Suppose that the transverse or longest diameter of

ellipsis or oval be 32 feet, and the conjugate or shortest diameter 24, what is the diameter of a circle, equal thereto?

Ans. 27.7 feet.+

Multiply the two diameters together, and extract the square root of the product.

TO EXTRACT THE SQUARE ROOT OF A VULGAR FRACTION.

RULE.

Reduce the fraction to its lowest terms; and, if it be a mixed number, reduce it to an improper fraction; then, extract the square root of the numerator for a new numerator; and the square root of the denominator for a new denominator.

EXAMPLES.

1. What is the square root of [illegible]? Ans. $\frac{7}{9}$.

Reduce [illegible] to its lowest terms by case 2, reduction of vulgar fractions, and the result will be $\frac{49}{81}$; then extract the square root of 49 for a new numerator; and of 81, for a new denominator.

2. What is the square root of $\frac{180}{245}$? Ans. $\frac{6}{7}$.

Reduce the fraction to its lowest terms, then proceed as directed.

3. What is the square root of $\frac{1296}{1521}$? Ans. $\frac{12}{13}$.

4. What is the square root of $7\frac{1}{9}$? Ans. $2\frac{2}{3}$.

Reduce the given number to an improper fraction, &c. Observe, if it be an improper fraction, reduce it to its proper terms.

NOTE. If the fraction be a surd, that is, a number whose root can never be exactly found: Reduce the fractional part to a decimal, and annex it to the whole number, (if any be given,) and extract the square root therefrom.

5. What is the square root of $14\frac{2}{7}$? Ans. 3.779 and 4873 rem.

Reduce the $\frac{2}{7}$ to a decimal; by case 3, reduction of decimals, and annex the result to the 14; then, extract the square root of that number.

6. What is the square root of $86\frac{328}{392}$? Ans. 9.318 and 11610r.

EXTRACTION OF THE CUBE ROOT.

To extract the cube root, is to find out a number, which being multiplied into itself, and again into the product, will produce the given number.

The cube root of 125 is 5; consequently, 5 multiplied by 5, and that product again by 5, produces 126, as in the following

2	3	4	5	6	7	8	9
8	27	64	125	216	343	512	729

A cube is any number, multiplied by its square.

To extract the cube root.

RULE.

1. Separate, or point off, the given number, into periods of three figures each, placing a point over the first, or unit figure, and likewise every third figure from the place of units, to the left; and if there be decimals, over every third figure from the decimal point, to the right.

2. Find the greatest cube in the left hand period of the given number, and place its root as a quotient.

3. Subtract the cube thus found from said period; and, to the remainder, bring down the next period, or three figures, and call this the dividend.

4. Multiply the square of the quotient by 300, and call it the divisor.

5. Seek how often the divisor is contained in the dividend, and place the result in the quotient.

6. Multiply the divisor by the last quotient figure, and place the product under the dividend.

7. Multiply the quotient figure or figures obtained before, by the square of the last quotient figure; then, multiply the product by 30, and place the result under the last. Then, find the cube of the last quotient figure, and place it under the two last products; the sum of these, call the subtrahend.

8. Subtract the subtrahend from the dividend; and, to the remainder, bring down the next period, or three figures, for a new dividend.

Then commence again, by multiplying the square of the quotient by 300, for a divisor; and so on, till the whole is finished.

Note 1. If the subtrahend is greater than the dividend, you must make the last quotient figure one less, and form a new subtrahend by the rule; and so do, until you can subtract the subtrahend from the dividend.

2. If the decimal places do not consist of an even period, or periods; that is, if there be one or two odd figures, you may add ciphers to the decimal, to make up an even period.

3. Place the decimal point in the cube root, as directed in the square root; note 2.

EXAMPLE FOR ILLUSTRATION.

1. What is the cube root of 268336.125? Ans. 64.5

```
                        .   .   .
                      268336.125(64.5
       6×6×6=         216
                      ---
 6×6×300=10800)52336 1st dividend.
                      -----
                      43200
     4×4×6×30=         2880
     4×4× 4=             64
                      -----
                      46144 1st subtrahend.
                      -----
64×64×300=128800)6192125 2nd dividend.
                        -------
                        6144000
 5×5×64×300=              48000
      5×5×5=                125
                        -------
                        6192125 2nd subtrahend.
                        -------
                              0
                        -------
```

According to rule, I pointed off the sum into periods of 3 figures each, beginning at the units place; I then sought the greatest cube in the left hand period, (268,) this by the table is 216, and the root 6; the 6, I placed as a quotient, and subtracted the cube from said period; I then brought down the next period, (336,) and annexed it to the remainder; this, I called the first dividend; I then multiplied the square of the quotient, (6,) by 300, for a divisor, this brought 10800; I sought how often the divisor was contained in the dividend, which was 4 times; I multiplied the divisor by it, placing the product, (43200,) under the dividend, and then multiplied the square of the last quotient figure, (4,) by the quotient obtained before, (6,) and that product by 30; here, I got 2880; I placed this under the other, and then cubed the last quotient figure, (4,) the product, (64,) I placed under the other two, adding the whole together for a sub[illegible]d; this brought 46144, this subtrahend I subtracted [illegible] dividend, and brought down the next period, [illegible]w dividend; here, I commenced the rule again, [illegible] the square of the quotient, (64,) by 300, for a new divisor; this brought 122880. I sought how often this divisor was contained in the dividend, which was 5 times; I multiplied the divisor by this, and placed the product 6144000, under the 2d dividend; then, I multiplied the square of the last quotient figure (5) by the quotient obtained before, (64,) and that product by 30; placing the result (48000) under the last; I then cubed the last quotient figure, (5) and placed the number (125) under the other two products, and added them together for a new subtrahend; by subtracting, I got 0 remainder, which shewed the number to be a perfect cube.

EXAMPLES.

2. What is the cube root of 946967·92?

Ans. 98.2 and 1752 rem.

. . .
946967.920(9
9 X 9 X 9 = 729
———
)217967 1st dividend.

I pointed off the given number into periods of three figures each, and as there were two figures in the decimal, I added a cipher, as directed, to make up the period. By examining the question, the learner will see that I have gone according to rule, to which strict attention must be paid, in order to find the result.

3. What is the cube root of 41063625? Ans. 345

. . .
41063625(3

I have pointed off the number, according to rule; the first period is 41, the greatest cube contained in this is 27, and its root 3; proceed on, carefully observing the rule.

4. What is the cube root of 625·0072?

Ans. 8.55 and 40825 rem,

When pointing off the decimal, add two ciphers to make up the period.

5. What is the cube root of 91·125? Ans. 4.5

6. What is the cube root of 19248832? Ans. 268

7. What is the cube root of 44869·482?

Ans. 35.5 and 130607 rem.

8. What is the cube root of 48787.170264? Ans. 36.54

Proceed to find the 4th figure, as you did the second and third; you will find the third divisor thus: 365 X 365 X 300; proceed.

9. What is the cube root of ,000094827486?

Ans. .0456 and 8670 rem.

Placed and pointed off thus: .000094827486(4

APPLICATION.

10. If the statute bushel contain 2150·425 cubic or solid inches; what is the side of a box, in form of a cube, that shall contain a bushel? Ans. 12·9 inches and 3736 rem.

or more exact, 12·907 in. rem.

Extract the cube root of the given number.

11. Suppose a piece of marble in form of a cube, contain 21952 solid inches; what is the superficial content of one of its sides? Ans. 784 inches.

Extract the cube root of 21952; then, square the root thus found.

12. If a cannon-ball, 4 inches in diameter, weigh 12lbs. what is the weight of another ball, that measures 8 inches? Ans. 96lbs.

Say, as 12lbs. is to the cube of 4 so is 96lbs. to &c. Extract the cube root of the quotient, for the diameter required.

13. If a ball, or globe of silver, 4 inches in diameter, be worth 192 dollars; what is the worth of another, whose diameter is 8 inches. Ans. 1536 dolls.

Say, as the cube of 4 inches is to $192 so is the cube of 8 inches to &c.

14. Suppose you have a box, in form of a cube, whose side measures 3 feet; what is the side of another box, that shall contain 4 times as much? Ans. 4,76ft. and 149824rem.

Multiply the cube of the given side by the proportion 4, and extract the cube root of the product.

15. If I have a cask, 42 inches long, and 30 inches bung diameter, and I wish a cooper to make another of the same shape, that shall hold just three times as much; what will be the dimensions of said cask? Ans. The length, 60.5 inches and 818875 rem. and at the bung diameter 43.2 in. & 378432 r.

Multiply the cube of the length by 3, and extract the cube root of the product; proceed the same with the bung diameter.

TO EXTRACT THE CUBE ROOT OF A VULGAR FRACTION.

RULE.

Observe the same directions that were given in the square root for preparing the fractions; then, extract the cube root of the numerator for a new numerator, and of the denominator for a new denominator.

EXAMPLES.

1. What is the cube root of $\frac{72}{1125}$? Ans. $\frac{2}{5}$.

Reduce the fraction to its lowest terms; and then, proceed according to rule.

2. What is the cube root of $\frac{500}{2068}$? Ans. $\frac{5}{8}$.

Note if the fraction be a surd, reduce it to a decimal and annex it to the whole number, (if any,) and extract the cube root of it.

3. What is the cube root of $4\frac{2}{9}$? Ans. 1.61 and 48941 rem.

Reduce the $\frac{2}{9}$ to a decimal, you may get 6 figures; annex it to the 4, and extract the cube root of it.

4. What is the cube root of $\frac{3}{7}$? Ans. 752 and 873920 rem.

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* To find the dimensions of any body that shall be so many times less than the given dimensions; divide by the given proportion, instead of ultiplying.

REDUCTION OF CURRENCIES.

To reduce the currencies of the several United States,* into Federal money.

Note.—If at loss to know how much is reckoned to the dollar, refer to the table, page 103.

Case 1. To reduce the currencies of the states, where a dollar is an even number of shillings, to Federal money.

Rule 1. When the given sum consists of pounds only, annex a cipher, and divide by half the number of shillings in a dollar.

2. When the given sum consists of pounds, shillings, &c. bring the given sum into shillings, and reduce the pence, and farthings, (if any,) to the decimal of a shilling, annex it to the shillings, and divide by the shillings in a dollar; the quotient will be the answer in dollars, &c.

EXAMPLES.

1. Reduce 49£. New York, and North Carolina currency, into Federal money. Ans. $122.50cts.

Annex a cipher to the 49, and divide by half the number of shillings in a dollar; add two ciphers to bring the cents.

Note.—Adding a cipher to the pounds multiplies by 10, this brings tenths of a pound; and as a dollar is four tenths of a pound N. Y. currency, dividing by 4 brings them into dollars, &c.

2. Bring 21£. 18s. 6¼d. New England, and Virginia currency, into Federal money. Ans. $73.08cts. 6m. +

Reduce the pence, and farthings to a decimal; reduce the pounds to shillings; annex the decimal, and divide by 6, the shillings in a dollar.

3. Bring 30£. New England, and Virginia currency, to Federal money. Ans. $100

Annex a cipher and divide by half the shillings in a dollar.

4. Bring 19. £17s. 6½d. Kentucky, and Tennessee currency, into Federal money. Ans. $66.25cts. 6m. +

Reduce the 6½d. to a decimal, annex it to the shillings, &c.

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* Note. Before the revolutionary war in America, the pound was of the same sterling value in all the colonies, as in Great Britain; and the spanish dollar worth 4s. 6d. but the Legislature of the different colonies emitted bills of credit, which afterwards depreciated in their value; in some states more, and in others less; for which reason the dollar is reckoned as in the table, in Reduction of Currencies, page 103.

5. Change 27£. 6s. 6d. New York, and North Carolina currency, into Federal money. Ans. $68.31cts. 2m.+

Reduce the 6d. to a decimal, and proceed.

6. Reduce 220£. New York, &c. currency, into Federal money. Ans. $550

7. Reduce 18s. 6¾d. North Carolina, &c. currency, to Federal money. Ans. $2.32cts.+

Find the decimal of 6¾d. annex it to the 18, and divide by ——.

Case 2. To reduce the currency of the following states, viz New Jersey, Pennsylvania, Delaware, and Maryland, into Federal money.

Rule. If the given sum consists of pounds, shillings, &c. reduce the shillings, &c. to a decimal, and annex it to the pounds; then multiply by 8, and divide by 3, the quotient will be the answer, in dollars, &c.

EXAMPLES.

1. Reduce 16£. 17s. 4d. Pennsylvania currency, to Federal money. Ans. $44.74cts. 2m. +

Reduce the 17s. 4d. to a decimal, annex it to the 16*l.* and multiply by 8, and divide by 3.

Note. The reason for this rule is, a dollar is 7s. 6d. or 90 pence: a pound 240 pence consequently, a dollar is $\frac{90}{240}$, or $\frac{3}{8}$ of a pound.

2. Reduce 28£. Delaware currency, to Federal money. Ans. $74.66cts. 6m. +

Multiply by 8, &c. add ciphers if necessary.

3. Reduce 109£. 14s. 4¾d. New Jersey, Pennsylvania. Delaware, and Maryland currency, to Federal money. Ans, $292.58cts. 6m.+

Case 3. To reduce the currency of South Carolina, and Georgia, to Federal money.

Rule. If there be shillings, &c. in the given sum, reduce them to a decimal as before; annex them to the pounds, and multiply by 30, and divide by 7; the quotient will be the answer in dollars, &c.

EXAMPLES.

1. Reduce 248£. 17s. 6d. Georgia currency, into Federal money. Ans. $1066.61cts. 5m. +

Reduce the 17s. 6d. to a decimal, annex it to the pounds; then, multiply by 30, and divide by 7. The decimal is .877, find it.

Note. The reason of the rule is, a dollar is 56d. a pound 240d [illegible] $\frac{56}{240}$, or $\frac{7}{30}$ of a £.

£. South Carolina currency, to Federal money. Ans. $205.71cts. 4m

y 3 there will be a remainder; add ciphers.

3. Reduce 168£. 9s. 6½d. South Carolina, and Georgia currency to Federal money. Ans. $722.04cts. 4m.

Reduce the 9s. 6½d. to a decimal, and proceed.

Case 4. To reduce the currency of Canada, and Nova Scotia, to Federal money.

Rule. Reduce the shillings, &c. to a decimal as before, then multiply by 4.

EXAMPLES.

1. Reduce 29£. 7s. 6d. Canada currency to Federal money. Ans. $117.50cts.

The decimal of 7s. 6d. is .375, find it, and annex it to the 29; then, multiply by 4, &c. Note. The reason of the rule is, 5s. are equal to a dollar; consequently 4 dollars make a pound.

2. Reduce 24£. 5s. Nova Scotia currency, to Federal money. Ans. $97

3. Reduce 68*l*. 14s. 9¾d. Canada, and Nova Scotia currency, to Federal money. Ans. $274.95cts. 4m. +

Case 5. To reduce British, or Sterling money, to Federal money.

Rule. If there be shillings, &c. proceed as before; then multiply by 40 and divide by 9.

EXAMPLES.

1. Reduce 46*l*. British, or Sterling money, to Federal money. Ans. $204,44cts. 4m. +

Add ciphers when dividing by 9, if necessary.

2. Reduce 27*l*. 14s. 6d. Sterling money into Federal money. Ans. $122.22cts. 2m. rem.

3. Reduce 49*l*. 2s. 8¾d. British or Sterling money, into Federal money. Ans. $218.37. 5m.

Case 6. To reduce Irish money into Federal money.

Rule. If there be shillings, &c. proceed as before; then multiply by 160, and divide by 39.

EXAMPLES.

1. Reduce 40*l*. Irish, to Federal money. Ans. $164.10cts. 2m. +

When dividing by 39, add ciphers to get the answer.

Reduce 57*l*. 14s. 7½d. Irish, to Federal money. Ans. $236.84cts. 6m. +

REDUCTION OF COIN.

To reduce Federal money to the currencies of the several United States, likewise to the currencies of Canada, Nova Scotia, *Great Britain*, and Ireland.

Case 1. To reduce Federal money to the currencies of the New England States.

Rule. Multiply the given sum by .3 (tenths,) and the product will be pounds, and decimals of a pound.

EXAMPLES.

1. Reduce $269,40cts. to New England currency.

Ans. 80*l.* 16s. 4d. 3.2qr.

Place the dollar,&c. thus, 269.40 and multiply by .3; proceed with the decimals, as in case 3d. reduction of decimals; mind where you place the decimal point.

Note. The reason of the rule is, 72d. is a dollar, N. E. &c. currency, and 240d. a pound, consequently the dollar is $\frac{72}{240}$ of a *l.* which is $\frac{3}{10}$ or .3 which is the same in value.

2. Reduce $48. 39cts. to Virginia currency.

Ans, 14*l.* 10s. 4d. +

Multiply 48.39 by .3, &c.

3. Reduce $194.89cts. to Kentucky currency.

Ans. 58*l.* 9s. 4d. +

4. Reduce $291.43cts. 5m. to Tennessee currency.

Ans. 87*l.* 8s. 7d. 1qr. +

Write down the sum thus 291.435, and proceed.

Case 2. To reduce Federal money to the currency of New York, and North Carolina.

Rule. Multiply the given sum by .4, (tenths,) and proceed as in the last case.

EXAMPLES.

1. Reduce $145.20cts. to New York currency.

Ans. 58*l.* 1s. 7d. +

Place the dollars and cents as in the last case, and multiply by the .4, proceed with the decimal as before.

2. Reduce $245.58cts. 3m. to North Carolina currency.

Ans. 98*l.* 4s. 7d. 3qr. +

Write down the given sum as in the 4th ex. case 1, and proceed.

3. Reduce $1.94cts. to New York, and North Carolina currency.

Ans. 15s. 6d. +

Case 3. To reduce Federal money to the currency of New Jersey, Pennsylvania, Delaware, and Maryland,

Rule. Multiply the given sum by 3, and divide by 8, and proceed with the decimals as before.

EXAMPLES.

1. Reduce $35,22cts. 5m. to New Jersey currency.

Ans. 13*l.* 4s. 2d. +

n thus, 35.225, to get the shillings, &c, work as before.

149·21cts. to Pennsylvania currency.

Ans. 55*l.* 19s. 0d. 3qr. +

3. Reduce $289.48cts. to Delaware and Maryland currency. Ans 108*l*. 11s. 1d.+

Case 4. To reduce Federal money to the currency of South Carolina, and Georgia,

Rule. Multiply the given sum by .7 (tenths,) and divide the product by 3, and proceed as before.

EXAMPLES.

1. Reduce $164.28cts. to South Carolina, and Georgia currency. Ans. 38*l*. 6s. 7d. 2.72qrs.

Mind and place the decimal point in its proper place.

2. Reduce $295.41cts. to Georgia currency.
Ans 68*l*. 18s. 6d. 3qrs. +

Case 5. To reduce Federal money to the currency of Canada, and Nova Scotia.

Rule. Divide the given sum by 4; the quotient will be the pounds, &c.

EXAMPLES.

1. Change $195.46cts. 3m. to Nova Scotia currency.
Ans. 48*l*. 17s. 3d. 3.12qrs.

Divide 195.643 by 4; place the point where it ought to be.

2. Change $160.49cts. to Canada currency.
Ans. 40*l*, 2s, 5d, 1qr.

Case 6. To reduce Federal money into British, or Sterling money.

Rule. Multiply the given sum by .225 (thousandths,) or multiply by 9, and divide by 40; the result will be the pounds, &c.

EXAMPLES.

1. Change $150.40cts. to British, or Sterling money.
Ans. 33*l*. 16s. 9d. 2.4qrs.

Place the point correct, proceed with the decimals as before.

2, Change $293.49cts. to British or Sterling money,
Ans. 66*l*, 0s, 8d. 1qr. +

Case 7. To reduce Federal money to Irish money.

Rule. Multiply the given sum by 39, and divide by 160; the quotient will be the pounds, &c.

EXAMPLES.

1. Change $100.20cts. into Irish money.
Ans. 24*l*. 8s. 5d. 2.8qrs.

Dividing by 160, will bring 24.4235, with which proceed as before.

2. Reduce $202.50cts. into Irish money.
Ans. 49*l*. 7s. 2d. 1qr.

the foregoing Currencies of the United States; also, the Currencies of Canada, Nova Scotia, Sterling and Irish Money; each to the par of all the others.

	New England, Ken. Virginia and Tennessee	New Jersey, Penn. Del. and Maryland	New-York and North Carolina	South Carolina and Georgia	Canada and Nova Scotia	British or Sterling money	Irish money
New England, Ken. Virginia and Tennessee		Add $\frac{1}{4}$ of the sum to itself	Add $\frac{1}{3}$ of the sum to itself	Multiply the sum by 7 and divide by 9	Multiply the sum by 5 and divide by 6	deduct $\frac{1}{4}$ of the sum from itself	Multiply the sum by 13 and divide by 16
New Jersey, Penn. Del. and Maryland	deduct $\frac{1}{5}$ of the given sum from itself		Add $\frac{1}{15}$ of the sum to itself	Multiply the sum by 28 and divide by 48	deduct $\frac{1}{3}$ of the sum from itself	Multiply the sum by 3 and divide by 5	Multiply the sum by 13 and divide by 20
New-York and North Carolina	deduct $\frac{1}{4}$ of the sum from itself	deduct $\frac{1}{16}$ of the sum from itself		Multiply the sum by 7 and divide by 12	Multiply the sum by 5 and divide by 8	Multiply the sum by 9 and divide by 16	Multiply the sum by 39 and divide by 64
South Carolina and Georgia	Multiply the sum by 9 and divide by 7	Multiply the sum by 45 and divide by 28	Multiply the sum by 12 and divide by 7		Multiply the sum by 15 and divide by 14	deduct $\frac{1}{28}$ of the sum frm itself	Multiply the sum by 117 and divide by 112
Canada and Nova Scotia	Add $\frac{1}{5}$ of the sum to itself	Add $\frac{1}{2}$ of the sum to itself	Multiply the sum by 8 and divide by 5	deduct $\frac{1}{15}$ of the sum frm itself		deduct $\frac{1}{10}$ of the sum frm itself	deduct $\frac{1}{40}$ of the sum frm itself
British or Sterling money	Add $\frac{1}{3}$ of the sum to itself	Multiply the sum by 5 and divide by 3	Multiply the sum by 16 and divide by 9	Add $\frac{1}{27}$ of the sum to itself	Add $\frac{1}{9}$ of the sum to itself		Add $\frac{1}{12}$ of the sum to itself
Irish money	Multiply the sum by 16 and divide by 13	Multiply the sum by 20 and divide by 13	Multiply the sum by 64 and divide by 39	Multiply the sum by 112 and divide by 117	Add $\frac{1}{39}$ of the sum to itself	deduct $\frac{1}{13}$ of the sum frm itself	

To find the rule by the foregoing table: First, find the given currency in the left hand column, then cast your eye towards the right hand, till you come under the currency required, and you will have the rule.

APPLICATION OF THE PRECEDING RULES.

EXAMPLE FOR ILLUSTRATION.

1. To change 82*l*. Connecticut currency, into New-York and North Carolina currency? Ans. 109*l*. 6s. 8d.

l.	s.	d.
3)82	0	0
27	6	8
109	6	8
l.	s.	d.

To find the rule, I found the given currency, viz. New England in the left hand column; and then, cast my eye to the right till I came under New York, where the rule says, add one third of the sum to itself; accordingly, I divided by 3, and added the quotient to the given sum, which brought the answer. Observe, To know which the New England states are, refer to the table, p. 103.

EXAMPLES.

2. Change 109*l*. 14s. 6d. New Jersey currency, into British or Sterling money. Ans. 65*l*. 16s. 8¼d. and rem.

By the table you will see that you must multiply by 3, and divide by 5, to bring New Jersey currency to British, or Sterling money. This may be done by compound multiplication and division.

3. Change 345*l*. 17s. 4d. New York and North Carolina currency, into New Jersey, &c. currency. Ans. 230*l*. 10s.

The rule in the table says, deduct $\frac{1}{16}$, &c. Divide by 16 and subtract the quotient from the given sum.

4. Change 200*l*. Delaware and Maryland currency into British or Sterling money. Ans. 120*l*.

Examine the rule in the table; it says, multiply by 3 and divide by 5.

5. Change 30*l*. 17s. 6d. New England currency into Irish money. Ans. 25*l*. 1s. 8d. 2qrs. and rem.

The rule says, multiply by 13 and divide by 16. Note. When necessary, reduce the shillings, &c. to a decimal.

5. Change 48*l*. 17s. 4d. Massachusetts currency into New Jersey currency. Ans. 61*l*. 1s. 8d.

Massachusetts is a New England state. Find the rule and proceed.

7. Change 140*l*. Canada currency, into New York and North Carolina currency. Ans. 224*l*.

8. Change 195*l*. 10s. 8d. South Carolina and Georgia currency, into New England currency. Ans. 251*l*. 8s.

9. Change 40*l*. 8s. 6d. Canada, &c. currency into New England currency. Ans. 48*l*. 10s. 2d. 1qr. and rem.

10. *Reduce or change* 28*l*. 17s. 6d. [illegible]
to Connecticut or N. England cur[illegible]

11, Reduce or change 90*l.* New-York, &c. currency, into Irish money. Ans. 54*l.* 16s. 10d. 2qr.

12. Change 100*l.* sterling money, into New-York, &c. currency. Ans. 177*l.* 15s. 6d. 2qrs. and rem.

13. Change 49*l.* 10s. New Jersey, &c. currency, into New-York and North Carolina currency. Ans. 52*l.* 16s.

14. Change 40*l.* Irish, into New England currency. Ans. 49*l.* 4s. 7d. 1qr. and rem.

15. Change 91*l.* 17s. 4d. New-York, &c. currency into Virginia currency. Ans. 68*l.* 18s.

16. Reduce 100£. New Jersey currency, into South Carolina and Georgia currency. Ans. 62£ 4s. 5d. 1qr. and rem.

17. Reduce 40£ New Jersey, &c. currency, into Irish money. Ans. 26*l.*

18. Change 130*l.* South Carolina and Georgia currency, into British or Sterling money. Ans. 125*l.* 7s. 1d. 2qrs. and r.

19. Change 99*l.* 14s. 11d. Virginia currency, into Sterling money. Ans. 77*l.* 16s. 2d. 1q.

20. Reduce or change 48*l.* Canada, &c. currency, into Sterling money. Ans. 46*l.* 16s.

◆

DUODECIMALS.

Duodecimals are fractions of a foot, or an inch, or parts of an inch, having 12 for the denominator.

This rule is useful in casting up the content of any thing, where the dimensions, in length and width, or length, breadth, and width are given in feet, inches, &c. The denominations of this rule, are foot, inch, second, third and fourth—12 fourths make 1 third; 12 thirds, 1 second; 12 seconds, 1 inch; 12 inches, 1 foot; the denominations are denoted thus: ft. for feet; in. for inches; '' seconds; ''' thirds; and '''' for fourths.

MULTIPLICATION OF DUODECIMALS.*

RULE.

Set the feet in the multiplier under the least denomination in the multiplicand, and the rest in order, as in the example
then, begin with the lowest denomination, and
ound multiplication; dividing each prod

---

ubtraction of Duodecimals, are performed in the
ound addition and subtraction.

12, placing the first remainder under the figure you are multiplying by, and the rest in order, as you proceed. As you multiply, mind and place each product under the denomination by which it was produced; the sum of all the products will be the answer required.

NOTE. — Feet multiplied by feet produce feet.
Feet multiplied by inches produce inches.
Feet multiplied by seconds produce seconds.
Inches multiplied by inches produce seconds.
Inches multiplied by seconds produce thirds.
Seconds multiplied by seconds produce fourths.

EXAMPLE FOR ILLUSTRATION.

1. What is the content of a mahogany board, that measures 12 feet, 8 inches, 3 seconds in length, and 1 foot, 9 inches, 4 seconds in width? Ans. 22 feet, 6 inches, 8 seconds.

```
ft.  in.  ''
12   8    3
          1   9   4
--------------------
     4    2   9   0
 9   6    2   3
12   8    3
--------------------
22   6    8   0   0
ft.  in.  ''
```

According to rule, I placed the feet of the multiplier under the least denomination of the multiplicand, and the rest in order; then I began with the lowest denomination, and, multiplied as in compound multiplication, placing each product as directed in the rule, which you will see by examining the question. When I multiplied by 4, the first figure, I said, 4 times 3 are 12; then 12 into 12, once and 0 over; set down 0 and carry 1; again, 4 times 8 are 32, and 1 that I carry makes 33; 12 into 33, twice and 9 over; set down 9 and carry 2; four times 12 are 48, and 2 are 50; twelve into 50, four times and 2 over; this I set down as you see in the margin, and proceeded in the same manner with the rest.

NOTE.—When there are no feet in the multiplier, supply their place with a cipher, and do the same with any other denomination between the highest and lowest.

EXAMPLES.

2. How many feet are there in a board, that measures 12 feet, 3 inches long, and 2 feet, 9 inches wide?

Ans. 33 feet, 8 inches, 3 sec.

```
                ft.  in.
Placed thus;    12   3
                     2   9
                ----------
Placed thus;     ft.
by diameter,    12.25
                 2.75
                -----
```

Multiply as directed in the rule, saying, 9 times 3 are 27; twelve into 27, twice and 3, &c. This question can be done by decimals, by reducing the 9 in. and 3 in. to a decimal, and annexing them to the feet; as in the margin.

Multiply this last, and point off the decima then, find the proper quantity of the fract as before taught.

3. How many cubic feet of timber, in a stick that measures 8 feet, 6 inches in length; 1 foot, 9 inches broad, and 1 foot, 3 inches thick? Ans. 18ft. 7in. 1sec. 6th.

Multiply the length by the breadth, as in the last example; this will produce 14ft. 10in. 6sec. then, multiply by the 1ft. 3in. placing the 1ft. under the sec. and the inches as before; then, multiply and add as directed.

4. If you buy a board, 11ft. 6in. long, and 2ft. 3in. wide; how many feet does it contain? Ans. 25ft. 10in. 6sec.

5. How many square feet are there in a board that is 9ft. 9in. long, and 2ft. 10in. wide? Ans. 27ft. 7in. 6sec.

6. If you buy a stick of timber that measures as follows: 24ft. 9in. long, 2ft. 9in. broad, and 2ft. 3in. deep; how many feet does it contain? Ans. 153ft. 1in. 8sec. 3th.

Performed like the third example.

7. Suppose you have a cubic box, that measures 8ft. 10in. long, 3ft. 2in. broad, and 2ft. 11in. wide; how many feet are there in the whole? Ans. 81ft. 7in. 0sec. 4th.

8. What is the superficial content of a mahogany board, that measures 7ft. 2in. 3sec. long, and 1ft. 11in. 8sec. wide?
Ans. 14ft. 2in. 1sec. 3th.

9. If you buy a load of bark, that measures 7ft. 11in. long, 3ft. 1in. high, and 2ft. 10in. wide; how many feet does it contain, and how much does it come to, at $8.50cts. per cord?

Ans. The content is 65ft. 6in. 3sec. and it comes to $4.35cts.+

When you find what the bark comes to, say, as 128, the feet in a cord, &c,

10. How many feet are there in a square piece of board, that measures 2½ feet upon each side? Ans. 6ft. 3in.

ft. in. ft. in.
2 6 Or by decimals 2 . 5 The .5 is the decimal of 6
2 6 placed thus; 2 . 5 inches.

---

11. If a stone cutter puts up a piece of marble around your fire-place, that measures 4ft. 6in. 3sec. by 8in. 4sec. and charge $1.50cts. per foot for the same, what does it come to?
Ans. 4D. 70cts. 9m. +

After finding the number of feet, &c. state it; saying, as 1ft. is to 1D. 50cts. so is the feet, &c. found, to &c.

12. How many solid feet are there in a block of marble, that measures 7ft. 6in. long, 3ft. 9in. broad, and 3ft. 6in. wide?
Ans. 98ft. 5in. 3sec.

THE DOUBLE RULE OF THREE,

OR, COMPOUND PROPORTION.

In the Double Rule of Three, (or, as it is sometimes called, the rule of five,) there are five numbers given, to find a sixth; the first three of which are a supposition, and the last two, a demand.

Note.-If the proportion is direct, the sixth term, or answer, must bear such a proportion to the fourth and fifth as the third bears to the first and second. But if the proportion is inverse, then the sixth term or answer must bear such a proportion to the fourth and fifth, as the first bears to the second and third, or as the second bears to the first and third.

RULE FOR STATING THE QUESTION.

1, Of the supposition.—Let the principal cause of gain, loss, or action, be put or placed for the first term.

2. Let that which relates to time, distance of place and the like, be put in the second place, and the remaining one of the supposition, in the third place.

3, Of the demand.—Place the other two terms, (being those that move the question,) under those of the same name in the supposition.

RULE FOR WORKING THE QUESTION.

1. If the blank place* (or term sought,) fall under the third term, (the proportion is direct,) then multiply the first and second terms together, for a divisor, and the other three for a dividend; the quotient brought will be the sixth term or answer.

2. If the blank fall under the first or second term, (the proportion is inverse.) Then multiply the third and fourth terms for a divisor, and the other three for a dividend; the quotient will be the answer.

---

* In the supposition, there are three terms; but in the demand, there are only two; consequently, there must be one term that will not have any figure under it; that vacancy is the blank place.

EXAMPLE FOR ILLUSTRATION.

1. If 5 men can reap 20 acres of wheat in 4 days; how many acres can 12 men reap in 10 days? Ans. 120 acres.

	M.		D.		A.
Supposition,	5	:	4	::	20
Demand,	12	:	10		

5
4
——
20

10
——
120
20
——
2|0)240|0
——
120 acres.

I placed the principal cause, &c. (the men,) for the first term; then, for the second, the time; and the remaining one of the supposition; for the third term, I next placed the two demanding terms, under those of the same name: viz. the men under the men, and the days under the days; here, I observed that the blank fell under the third term; according to rule, I multiplied the first and second terms (the 5 and 4) together, for a divisor, and the other three (the 12, 10 and 20,) for a dividend; the quotient brought by dividing, was 120, the answer.

EXAMPLES.

2. If 4 men can mow 30 acres of grass in 3 days; how many men can mow 80 acres in 2 days? Ans. 16 men.

	M.		D.		A.
Supposition,	4	:	3	::	30
Demand			2	::	80

Here the blank falls under the first term in this case; the rule says, multiply the third and fourth terms for a divisor; and the other three for a dividend; accordingly, you must multiply the 30 and 3 for a divisor, and 4, 3, and 80, for a dividend; divide and the quotient will be the answer.

3. If the wages of 8 persons for 24 days, be 144 dollars: what will the wages of 12 persons, for 72 days be? Ans. 648D.

	P.		D.		dolls.
Stated thus;	8	:	24	::	144
	12	:	72		

Here the blank falls under the third term; the rule says, multiply the first and second terms for a divisor, and the other three for a dividend.

4. Suppose 4 bushels of rye be sufficient for a family of 9 persons, 15 days; how many bushels will serve 45 men 9 days? Ans. 12 bushels.

	P.		D.		B.
Stated thus;	9	:	15	::	4
	45	:	9		

The blank falls under the third term; proceed as in the last question.

5. If 100D. gain 7D. in a year; in what time will 800D. gain 42D? Ans. 9 months.

Place the terms of the supposition thus: 100D. : 12mo. :: 7D. place the term [illegible] emand under those of the same name; the blank will fall [illegible] m; multiply the 3d and 4th for a divisor, &c.

[illegible] surer put out 150D. to receive interest for the same; and when it had continued 11 months he took it up, and received for principal and interest, $158.25cts. at what rate per cent. per annum, did he receive interest? Ans. 6 per cent.

First, find the whole interest, by subtracting the principal from the amount; then state it, making 150D. the first term; the 11 months, the second; and the whole interest, the third; the demanding terms are, 100dolls. in 12 months.

8. What principal, at 7 per cent. per annum, will gain $42 interest in 9 months? Ans. $800

The terms of supposition are 100D. : 12mo. :: 7D. place the demanding terms under those of the same name; place the 42D. interest, under the third term.

9. What is the interest of 200£ for 195 days, at 6 per cent. per annum? Ans. 6£ 8s. 2d. 2qrs. and 19000 rem.

Place the terms of supposition thus: 100£ : 365 days :: 6£ &c.

10. If 12 men can build a wall 30 feet long, 5 feet high, and 2 feet thick, in 10 days; in what time can 20 men build one, 150 long, 6 feet high, and 3 feet thick? Ans. 54 days.

Find the number of feet in the wall; that is, multiply the length, breadth and thickness together, and make the product the third term in the supposition; find the number of feet in the other dimensions, and place it under its like in the supposition, &c.

11. If for 40 mile carriage of 3C. 2qrs. I pay 3D. 50cts. what must I pay for the carriage of 12C. 2qrs. 100 miles, at that rate? Ans. 31D. 25cts.

Reduce both C. &c. into quarters; then, place the 14qrs. for the first term of the supposition; the 40 miles; the second, &c.

* * *

POSITION.

Position, (or, as it is sometimes called, the rule of false,) is a rule made use of for finding the true number, or numbers by making use of false or supposed numbers. It is divided into Single and Double position.

SINGLE POSITION.

By this rule are answered, such questions as require only one supposition, to discover the true result.

RULE.

Suppose, or make choice of, any number, and perform with it the same operations as are directed to be performed in the question. Then say, as the result of the operation, (or number found,) is to the supposed number, so is the given number to the number sought. Proof; work with the answer, as directed in the question; and the result will be equal to the given number.

EXAMPLE FOR ILLUSTRATION.

1. Suppose a boy meets another that had been gathering nuts, and says, what, got 200 nuts already? ha! you are mistaken, my lad; I have not got 200; but if I had as many more, and half as many more beside the number I have, I should then have just 200; how many had he? Ans. 80 nuts.

Suppose he had 12
As many more, 12
$\frac{1}{2}$ as many more, 6
30
as 30 : 12 :: 200
200
3|0)240|0
80 true num.

Here I supposed 12, and worked with it as though it had been the true number; the question said as many more, so I put 12 under the supposed number; again it said half as many more; here I put 6 under the other, and added the whole together, which amounted to 30; then stated it; saying, as 30, the result of the position, is to 12, the position, so is 200, &c. to 80, the answer. I proved the question as in the margin, working as directed. Observe. It is best to make choice of a number that will perform the operation without a remainder.

Proof.
The number, 80
As many more, 80
$\frac{1}{2}$ as many more, 40
200

EXAMPLES.

2. Say, John, how many shillings are there in your purse? Says he, I will answer you in this manner: if its contents were $\frac{1}{2}$ as many, and $\frac{1}{4}$ as many, and $\frac{1}{8}$ as many more than are actually in it, I should have a purse containing 30 shillings; now, find the number of shillings in the purse. Ans. 16 shillings.

You may suppose 8, (or some other number, if you please,) and divide by the 2, 4, and 8, placing the quotients under the 8, the sum of these will be 15, (the result,) proceed according to rule.

3. Suppose K, L, and B, have 120 dollars to be divided between them, as follows: K. is to have a certain sum, L. is to have half as much as K; and B. is to have as much as both the others; what is the share of each?

Ans. K's. 40D. L's. 20D. and B's. 60D.

You may suppose K. to have 10, the result will be 30, which make the 1st term, and the second term will be as follows: 1st K's. supposed part, then L's. and lastly B's.

4. Suppose I hire out a sum of money, to receive interest for t [illegible] t 6 per cent. per annum, simple interest; and, at th [illegible] ars, I receive 510 dolls. for principal and inter- [illegible] he sum hired out? Ans. 375 dolls.

[illegible] and find the amount of it at the rate and time given; [illegible] ing the amount found the first term, &c.

5. Suppose I have a cistern with three unequal pipes, containing 60 hogsheads of water; the greatest pipe will empty it in an hour; the next in two, and the next in four hours; in what time will they empty it, supposing they all be set open at once? Ans. 34min. 17sec. 5rem.

You may suppose the whole emptied the cistern in 20 minutes, this being $\frac{1}{3}$ of an hour, consequently, the first will empty $\frac{1}{3}$, or 20 hhds. the second $\frac{1}{6}$, or 10 hhds. and the third $\frac{1}{12}$, or 5 hhds. the sum of these make the first term, and proceed.

6. Suppose you meet a friend coming from the bank, with a sum of money, and you are impertinent enough to ask him how much money he has; and he, to avoid a direct answer, tells you that $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of the sum makes just $870; how much had he? Ans. 600 dolls.

Suppose a number, and take the parts as directed, &c.

DOUBLE POSITION.

Double Position is, when two suppositions, or false numbers, are made use of to find the true result.

RULE.

1. Make choice of two convenient numbers, and proceed with each of them separately, according to the requirements of the question, and find how much each result is different from the result mentioned, noting when the errors are too great, or too little.

2. Place the errors against their respective positions, and multiply them cross-wise; that is, multiply the first position by the last error, and the last position by the first error.

3. If the errors are alike; (that is, if they be both greater or both less than the given number,) take the difference of the errors for a divisor, and the difference of the products for a dividend.

4. If the errors are unlike; that is, if one be too much, and the other too little; then, take the sum of the errors for a divisor, and the sum of the products for a dividend, and the quotient will be the answer.

EXAMPLE FOR ILLUSTRATION.

1. Suppose a man, driving his sheep to market, were asked if he had 200 in his flock, and being in rather an ill humour answered, count them; but, if you must needs know, if double the

number I now have, be added to half of the number, it will make 200; how many sheep had he? Ans. 80

Suppose he had	40	Again, suppose	60
Double the number	80	Double the number	120
Half the number	20	Half the number	30
	100		150
Given number	200	Given number	200
Error	— 100	Error	— 50

Pos. Err.
40 100
×
60 50

6000 2000
2000

5(0)400(0

80 Ans.

100 Err.
50 Err.

50 Diff. of Err.

Proof.—The number	80
Double the number	160
Half the number	40
	200

Here, I supposed 40; and, according to the question, I doubled the number; then, placed half the number under it, the sum of these made 100, which sum I subtracted from 200; the remainder was 100, for error; I then supposed 60, and worked in the same manner; this brought 50 for error; then, I placed the positions and errors as in the margin, and multiplied them crosswise, and as the errors were alike; that is, both less, I took the difference of the products for a dividend, and the difference of the errors for a divisor; the quotient brought by dividing was 80, which was the answer.

EXAMPLES.

2. Suppose a man, by will, should give to his three sons John, James, and Peter, the sum of 700 dolls. to be divided as

follows: to John as much as fell to his share, James to have double his share, lacking 10 dollars; and Peter to have as much as both the others; what must each have?

Ans. John 120 dolls. James, 230, and Peter 350.

Po. Err.
60 360
×
80 240

Here, you may suppose 60, and 80, and work as directed; the first will bring 360 error; the last 240, which you may place with the position, as in the margin, and proceed; the errors are alike; that is, both less, consequently you must take their difference for a divisor, and the difference of the products for a dividend. This will bring 120 dollars, John's part; you may find the others from the nature of the question; or take the other parts of the supposition and place them as in the margin; multiply as before, and divide by the same divisor; the quotient will be James' part.

Po. Err.
110 360
×
150 240

Po. Err.
170 360
×
230 240

By working in the same manner with this, you will find Peter's share.

3. What number is that, which being increased by its $\frac{1}{2}$ its $\frac{1}{3}$ and 5. more will be doubled? Ans. 30.

Here, you may suppose, 6 and 12; the error of the first will be 4, and of the last 3; the position and errors to be placed,

Thus; Po. Err.
6 4
×
12 3

Proceed as before. Note, the errors are alike, being both too little.

4. Divide 100£. between Samuel, David, and Richard, so that David may have 10£. more than Samuel, and Richard 5£. more than David.

Ans. Samuel, 25£. David, 35£. and Richard 40£.

Suppose 10 and 20, and work according to the requirements of the question; the first error will be 45, the last 15, &c.

5. Suppose three boys, O. C. and H. had 300 plums, to divide between them; but disagreeing, each seized on as many as he could; O. got a good share, C. got $\frac{1}{2}$ as many, and 5 more; and H. got half of the sum of both the others; how many did each get? Ans. O. got 130, C. 70, and H. 100.

You may suppose 10 and 50, the first, will bring 270 Err.

6. Suppose a farmer sells a number of cattle, for 600 dolls. and receives for every ox, 40 dolls. for every cow, 20 dolls. and for every calf, 6 dolls. for every ox, there were 5 cows; and for every cow, two calves; how many were there of each sort? Ans. 3 oxen, 15 cows, 30 calves.

You may suppose 5 and 4, for the number of oxen: then, work with the 5.

D.
Thus; 5 oxen, at 40 = 200
25 cows, at 20 = 500
50 calves, at 6 = 300
1000
600
Err. 400

Having supposed 5 to be the number of oxen; there must be 25 cows, and 50 calves; after having found what they come to, viz. 1000; the error is found by subtracting the given sum from the 1000, proceed with the supposition 4, in like manner: when you place the positions, take the 5 position, and 400 error found by it, &c.

7. Suppose a gentleman hires a gardener to work 30 days for him, upon these conditions; that, for every day he worked, he should have 6s. and for every day he was idle, to forfeit 3s. and at the end of the time, the gardener had 4£. 19s. due him; how many days work did he do, and how many days was he idle? Ans. He worked 21 days, and was idle, 9.

days. s.
Suppose he worked 20 at 6 = 120
Idle 10 at 3 = 30
90
99
9

£. s.
4 19
20
99

Then suppose he worked, 21
Idle, 9

Proceed as before.

Here the errors will be alike; so, according to rule, you must add the products for a dividend, and add the errors for a divisor.

8. If a General, being asked the number of men in his army, answers, count them; but, if you are desirous of knowing, I will inform you that I have not got 5000, as you may suppose; but if when my men are on parade, and stand in an exact square, you multiply the number in the front rank by 2, 3, 4, and umber produced, will fall short by five times the num- s in front of 5000; be so good as to find how many be nt, and what is the number of men?

Ans. 40 in front, and consequently 1600 men.

If you please, you may suppose 20 and 30, and work thus—20, multiplied by 2, 3, 4, and 5, will produce 2400; from this, deduct 5 times the supposition, (100,) the number in front; the difference between this and the 500, is the error; work with the 30 in the same manner, the result of the operation will be 40, which squared will give the number of men.

ARITHMETICAL PROGRESSION.

Arithmetical progression, is when a rank or series of numbers increase, or decrease, by a common difference.

Thus; { 2 4 6 8 10 &c. is an ascending arithmetical series*
{ 10, 8, 6, 4, 2,&c. is a descending arithmetical series.

Here the common difference is 2.

Or, 3. 6. 9. 12. 15, &c. here the common difference is 3.

Again, 5. 10. 15. 20, &c. here the common difference is 5.

The numbers which form the series are called the terms of progression; the first and last terms are called the extremes.

In arithmetical progression, there are five parts, viz. the first term, the last term, the number of terms, the common difference, and the sum of all terms; any three of which being given, the other two may be found.

Case 1st. When the first term, the number of terms, and the common difference are given, to find the last term.

Rule. Subtract the common difference, from the product of the number of terms multiplied by the common difference; the remainder added to the first term, will give the last.

Case 2. When the two extremes, (that is, the first and last terms,) and the number of terms are given, to find the sum of all the terms,

Rule. Multiply the sum of the two extremes, by the number of terms, and half the product will be the answer. Or, multiply the sum of the two extremes by half the number of terms.

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* In any series of numbers, in arithmetical progression, the sum of the two extremes is equal to the sum of any two terms equally distant from them; as in the series above, 2 + 10, is equal to 4 + 8, &c.

When the number of terms is odd, the double of the middle term is equal to the sum of the two extremes, or any two terms equally distant from the middle term, as in the series before mentioned, 6 + 6 is equal to 2 + 10, &c.

EXAMPLE FOR ILLUSTRATION.

1. If you buy 18 yards of muslin, giving 1 cent for the first yard, 3 for the second, 5 for the third, &c. in arithmetical progression; what does it come to? Ans. 3D. 24cts.

To find the last term.		To find the sum of all the terms.	
Number of terms	18	The 1st. term	1 ct.
× By the com. difference	2	Last term as found	35
	36		36
Sub. com. difference	2	Half the number of yds.	9
	34	Sum of all the terms	$3.24
Add 1st term	1		Ans.
Last term	35		

I, first, found the last term by case 1st, which was 35cts. then, according to case 2d, I found the sum of all the terms; this was done by adding the sum of the two extremes, (that is, what the 1st yd. and last yd. cost,) together; and, then I multiplied by half the number of terms, or yards; this brought the sum of all the terms. It would have brought the same answer, had I multiplied by the whole number of terms 18, and divided by 2, as directed in one part of the rule.

EXAMPLES.

2. If a butcher buys 50 sheep, and gives for the first sheep 1 shilling; and for the last 4*l.* 19s, what does the whole come to? Ans. 125*l.*

The first term is 1, and the last, 4*l.* 19s. or 99s. proceed according to rule.

3. How many strokes does the hammer of a clock strike in 12 hours? Ans. 78

As the common difference is 1, the extremes are 1, and 12; for the clock strikes 1, at one o'clock; and 12, at twelve o'clock; the number of terms are 12, proceed.

4. If a merchant sells 30 yds. of drugget, at 3 cts. for the first yard, 6 for the second, 9 for the third, &c. increasing 3 cents every yard; what does the whole come to?

Ans. 13D. 95cts.

First, find what the last term is, by case 1st. thus; 30×3−3+3=90, last term; to find the sum of all the terms, proceed by rule 2.

5. Suppose 150 eggs were placed in a right line, just three yards a part; and a basket placed three yards from the first egg; how many miles will a man have to travel, to gather them singly, and place them into the basket?

Ans. 38m. 4fur. 190yds.

He would have to travel 6 yards, to place the 1st. egg in the basket; that is, 3 yds. to the egg, and 3 back; by working, you will find the distance from the basket to the last egg, 450 yds. and then back again, 900; so, to find the whole distance travelled, you will have 6 for the 1st term, 900 for the last, and 150 for the number of terms.

Case 3d. The two extremes, (that is, the first and last term,) and the number of terms given, to find the common difference.

Rule. Divide the difference of the two extremes by the number of terms less, (or lacking,) one, and the quotient will be the common difference.

EXAMPLE FOR ILLUSTRATION.

1. Suppose a man had 9 children, whose ages differed alike, in arithmetical progression; the youngest being 4 years old, and the eldest 28; what is the difference of their ages, and the age of each

			4	age of the 1st.
			4+3= 7	2d.
			7+3=10	3d.
	Eldest	28	10+3=13	4th.
9	Youngest	4	13+3=16	5th.
1		—	16+3=19	6th.
—		8)24diff extremes	19+3=22	7th.
8		—	22+3=25	8th.
—		3 common diff.	25+3=28	9th.
		—		

EXAMPLES.

2. Suppose a debt is to be discharged at 6 several payments in arithmetical proportion; the first to be 10 dolls. and the last 160 dolls. what must each payment be, and what is the whole debt? Ans. The common difference is 30 dollars, and the whole debt, 510 dolls.

The difference between 160, and 10, will be the difference of the extremes; the remainder divided by 6, less 1, will be the common difference, which place as you may see.

	Dolls.	
	10	1st payment.
10 + 30 =	40	2
40 + 30 =	70	3 &c.

By proceeding as directed, you will find what each payment must be, and the sum of all the payments will be whole debt; which may be found by the rule under case 2, thus 10 + 160 = 170 sum of the extremes; then, 170 × 3 (half the number of terms,) will be the answer.

3. Suppose a man is to travel from New York to a certain place in 8 days, and to go 4 miles the first day, and 46 the last day, increasing every day with an equal excess; required the daily increase, and the length of the journey.

Ans. The daily increase is 6 miles, and the whole journey 200 miles.

Find the common difference as before; to find the whole journey proceed according to case 2.

Case 4th. When the two extremes and common difference are given, to find the number of terms.

Rule. Divide the difference of the two extremes by the common difference, and add one to the quotient; the sum will be the number of terms.

EXAMPLES.

1. Suppose a man being asked how many children he has, answers, my youngest child is 4 years old, and my eldest is 28, and the difference of their ages is 3 years; how many children has he? Ans. 9 children.

The extremes are 28; and 4, the common difference 3; remember to add one to the quotient.

2. A man setting out on a journey, travels 5 miles the 1st day, and increases every day's journey by 3 miles, till at last he travelled 68 miles in one day; how many days did he travel? Ans, 22 days.

GEOMETRICAL PROGRESSION.

Geometrical Progression is when any rank or series of numbers increase by one common multiplier or decrease by one common divisor.

As 2, 4, 8, 16, &c. here the common ratio* is 2.

Again, 81, 27, 9, 3, here the common divisor, or ratio is 3: the first mentioned is called an ascending, and the last, a descending series. In any series of numbers in geometrical progression, the product of the two extremes, will be equal to the product of any two means equally distant from the extremes. As

---

* The number by which the series increase, or decrease, is called the

3, 9, 27, 81, 243, 729. Here, the extremes, 3 × 729, 9 × 243, and 27 × 81, produce the same result, viz. 2187. If the terms are odd, the middle term multiplied by itself will be equal to the two extremes; as, 3, 6, 12, here, 6 × 6, produce the same as 3 × 12. In geometrical progression, as in arithmetical progression, there are five things observed, viz. the first term, the last term, the number of terms, the ratio, and the sum of all the terms; any three of them being known, the rest may be found.

CASE I.

When the first term and ratio, are given, to find any other term assigned.

RULE.

Raise the ratio to a power one less than that denoted by the number of terms. Multiply this product by the first term; the result will be the term required.

EXAMPLE FOR ILLUSTRATION.

1. If the first term be 4, and the ratio 3; what is the 15th term? Ans. 19131876

1st power.	2d power.	3d power.	4th power.	5th power.
3	9	27	81	243

243	
243	
729	
972	
486	
59049	tenth power.
81	fourth power.
59049	
472392	
4782969	14th power.
4	first term.
19131876	15th term.

According to rule, I raised the ratio to a power, one less than the given number; that is, I raised the ratio to a 14th power; I found the 5th power as in the example, and then I multiplied the 5th power by the 5th, this produced the 10th; then, I multiplied the 10th by the 4th; this last product was the 14th power. As directed, I then multiplied by the first term; the result was the 15th term.

EXAMPLES.

2. Suppose the first term be 1, and the ratio 4; what is the 12th term? Ans. 4194304

Raise the ratio 4, to the 11th power; one less than the given number; commence thus, 4, 16, 64, 256, the 256 is the 4th power, the 4th multiplied by the 4th, and that product by the 3d. will be the 11th; then —— by the 1st term.

3. Suppose a sum of money is to be divided between 18 men; the first man is to have 2 dolls. the ratio 5; what will be the 18th, or last man's share? Ans. 1525878906250

Raise the ratio to the 17th power, then —— by the 1st term.

CASE II.

When the first term, ratio, and number of terms are given, to find the sum of all the terms.

RULE.

Raise the ratio to a power equal to the number of terms given; subtract 1, and multiply the remainder by the first term; then, divide this product by the ratio less 1; the result will be the sum of all the series, or terms.[*]

EXAMPLE FOR ILLUSTRATION.

1. Suppose you bargain for 18 yards of broad cloth, agreeing that the price shall be as follows: viz. 1 cent for the first yard; 2 cents for the second, 4 for the third, and so on, doubling it for every yard; be so good as to find what the cloth comes to at that rate. Ans. $2621.43cts.

Note.—The sum of all the series is the sum total of all the terms placed under each other, and added together.

	1st power.	2d power.	3d power.	4th power.	5th power.	6th power.
Ratio.	2	4	8	16	32	64

64
64

250
384

4096 12th power
64 6th power

16384
24576

262144 18th power
1

262143
1 first term

Ratio 2—1=1)262143

2621.43
D. cts.

According to rule, I raised the ratio to a power equal to the number of terms given in the question; that is, 18; as directed I subtracted 1, and then multiplied by the first term 1; and lastly divided by the ratio less 1; the result was the sum of all the series or terms; multiplying by the first term, and dividing by the ratio, less 1 did not alter the question, as the first term was 1, and the ratio less 1, was one.

EXAMPLES.

2. Suppose a school-teacher agrees to take the charge of a school for a year; upon the following conditions, viz. to have 3 cents for the first month, 9 for the second, 27 for the third, &c. in triple proportion, geometrical; what will his wages amount to? Ans. $7971.60cts.

Here 3 is the ratio; commence thus, 3, 9, 27, 81, the last is the 4th power; the 4th × 4th will give the 8th; the 8th × the 4th, will give the 12th; the rule says, subtract 1; multiply by the 1st term, which is 3; and, lastly, divide by the ratio less 1, which is 2.

3. Suppose you buy 19 yards of silk, agreeing that the price shall be as follows; 2 farthings for the first yard, 6 for the second, 18 for the third, &c. what does the silk come to, at that rate? Ans. 1210689£. 0s. 6½d.

The ratio is 3, the first term 2; the number of terms, 19; commence with the ratio thus, 3, 9, 27, 81, 243, the 5th × the 5th gives the 10th; the 10th × the 5th gives the 15th, and the 15th × the 4th gives the 19th; go on according to rule.

4. If a man, driving his cattle to market, and meeting another, who asks him what he will take for his cattle, answers; there are 32 in all; and I will take 1 farthing for the first, 2 for the second, 4 for the third, &c. He, thinking this a rare bargain, agrees to it; be so good as to find what the cattle comes to at that rate!

Ans. 4473924£. 5s. 3d. 3qrs.

The first term is 1, number of terms 32; commence thus, with the ratio, 2, 4, 8, 16, 32, 64, 128, the last is the 6th power; 6th × 6th=12th the 12th × 12th,=24th the 24th × 6th=30th, the 30th × 2nd=32nd; attend to the rule; the answer will come in farthings, which bring into pounds.

5. Suppose a father tells his son, that he is willing to give him 10000 dolls. to set him up in trade; but his son, being a little ingenious, asks his father if he would not rather give him his fortune in the following manner; says he, I am just 21 years of age; now, be so good as to give me 1 cent for the first year, 2 cents for the second, 4 for the third, &c. doubling it every year till 21; his father, thinking his son's request moderate, agrees to it; please to find what it comes to, and whether the son gained any thing by his request?

Ans. It comes to 20971D. 51cts. he gains by his request 10971D. 51cts.

What is the ratio, the first term, the number of terms?

6. Suppose a farmer hires a man for 20 days, making the following bargain; viz. he is to work the 20 days, and to have nothing more than 4 wheat corns for the first days work, and 40 for the second, 400 for the third, and so on, in a tenfold proportion for the whole number of days; be so good as to find what the labour comes to, supposing the wheat to have been sold for 10s. per bushel.

Ans. 45211226851851£. 10s. rejecting rem.

Ratio 10, number of term 20, 1st term 4; after you have found the sum of all the terms or numbers of grains, divide by the grains in a pint, then bring the pints into bushels, and find what it comes to at 10s. per bushel

Note.—7680 wheat corns are supposed to make a pint, and 64 pints make a bushel.

7. If a gentleman is married on new-years day to the daughter of a wealthy merchant, who, being highly pleased with the match, asks his son-in-law, what present he shall make him, as a portion for his daughter; the son-in-law tells him he is very good, and says, if it please him, he may make him a present every day during that month, in the following manner, 2 cents the first day, 6 cents the second, 18 cents, the third day, &c. in triple proportion to the end of 31 days. The father-in law agrees to it, what portion does the daughter receive at that rate? Ans. $6176733962839.46cts.

3 is the ratio, 2 the first term, 31 the number of terms.

8. What will a watchmaker get for 20 gold watches, if sold in the following manner; 1 cent for the first, 4 for the second, 16 for the third, &c. in a quadruple proportion, and what is the average price? Ans. They come to $3665038759.25cts.
And the average price is, $183251937.96cts. 2m.+

4, is the ratio, 1, the first term, and 20 the number of terms.

PERMUTATION.

Permutation is showing how manny different ways any given number of things may be placed, or varied in their position.

To find the permutation or changes.

RULE.

Multiply all the given terms of the natural series from one up to the given number, continually together; the last product will be the number of changes required,

EXAMPLE FOR ILLUSTRATION.

1. In how many different positions can 6 men be placed?
Ans. 720

$$\begin{array}{r} 1\\ 2\\ \hline 2\\ 3\\ \hline 6\\ 4\\ \hline 24\\ 5\\ \hline 120\\ 6\\ \hline 720\\ \hline \end{array}$$

Here, according to rule, I multiplied all the given terms together, viz. 1, 2, 3, 4, 5, 6; the last product was the answer. Had there been but two men, they could not have been placed in more than two different positions, as, ab. ba. had there been 3 men they could have been placed in six different positions, thus, a b c, b c a, c a b, b a c, a c b, c b a, four men could have been placed in 24 different positions; five in 120, &c.

EXAMPLE.

2. Suppose, in a boarding house, there are 8 boarders; and one of the company, having a mind to make a bargain out of the landlord, offers him 50 dollars for his board, so long as they, (the 8 boarders,) together with the landlord, can sit every day at dinner in a different order; the landlord, thinking this a good bargain, agrees to it; I demand the number of positions, and how long they would have to stay at the boarding house, allowing the year to contain 365¼ days?

Ans. The number of positions 362880, and the time they would have to stay is 993 years 186¾ days.

Observe, the landlord made 9; proceed according to rule, to find the changes; to divide by the 365¼, reduce them to quarter days, and likewise multiply the changes, by 4; there will be a remainder, which divide by 4, to bring the days, or reduce the ¼ of a day to a decimal, and annex it to the 365, and divide, &c.

ALLIGATION.

CASE II.[*]

When the rates of several things are given, to find such tities of them as are necessary to make a mixture, which be at a rate propounded.

For the first case of Alligation, or Alligation Medial, see page 189.

RULE.

1. Reduce all the rates to one denomination, (if not already so.)

2. Place the rates of the simples in a column under each other and the mean rate on the left hand.

3. Connect, or link together the several rates, so that every one less than the mean rate, may be linked, or connected, with one or more that is greater.

4. Take the difference between each price and the mean rate, and place it opposite to that rate with which it is linked, or connected.

5. If only one difference stands against any rate, it will be the quantity belonging to that rate but if there are several, then their sum will be the quantity.

EXAMPLE FOR ILLUSTRATION.

1. How much corn, at 60 cents per bushel; buckwheat at 48cts. per bushel and oats, at 36 cents per bushel, will make a mixture worth 40cts. per bushel?

$$40\left\{\begin{array}{l|l} 60 & 4 \\ 48 & 4 \\ 36 & 20+8=28 \end{array}\right.$$

4 bushels, at 60 cents.
4 do. 48
28 do, 36

According to rule, I placed the rates in a column, and the mean rate on the left hand; then, I connected them together, one greater with one less than the mean rate, and then took the difference between 40, the mean rate, and 60, one of the given rates; the difference was 20; this I set against 36, the one with which it was linked; then, I took the difference between 40 and 48, which was 8; and this I likewise placed against the 36, it being connected with the 48; I, now, took the difference between 40 and 36, which was 4, and placed this against both the 60 and 48, for these were both linked with the 36; the result was 4bu. at 60cts. 4bu. at 48cts. and 28bu. at 36cts.

EXAMPLES.

2. Suppose a goldsmith would mix gold, of 18 carats fine, with some of 19, 20 and 24, so that the compound may be 22 carats fine; how much of each kind must he take?

$$22\left\{\begin{array}{l} 18 \\ 19 \\ 20 \\ 24 \end{array}\right.$$

Ans. 2 of the first three, and 9 of the last. I have placed these and linked them together; proceed, take the difference between the 22 and each of the other rates, and place them against those with which they are linked; the difference between the 22 and 18, 19 and 20, must be placed against the 24; and the difference between 24 and 22, against each of the others, &c.

3. Suppose it is required to mix several sorts of rum, as follows: at 6s. 8s. and at 10s. with water, at 0s. per gallon, to-

gether; so that, when mixed, it may be worth 7s. per gallon; how much of each sort must the mixture consist of?

Ans. 1gal. at 6s. 1gal. at 8s. 7gal. at 10s. and 3 gallons of water. Or, 3gal. at 6s. 7gal. at 8s. 1 gal. at 10s. and 1 gallon of water.

Place the prices and mean rate as before, and link them together; to find the first answer, you may link the 6 and 8, and the 10 and 0 together, to get the second answer, link the 6 and 10, and the 10 and 0, together.

4. Suppose a grocer has several sorts of sugar; viz. one sort at 16 cents per lb. another at 12 cents; a third at 8 cents; and a fourth, at 4 cents per lb. how much of each sort must be mixed together, that the whole quantity may be offered at 10 cents per lb?

1st Ans. 6lbs. at 16cts. 2lbs. at 12cts. 2lbs. at 8cts. 6lbs. at 4cts.
2d Ans. 2lbs at 16 6lbs at 12 6lbs at 8 8lbs at 4
3d Ans. 8lbs at 16 6lbs at 12 6lbs at 8 2lbs at 4
4th Ans. 8lbs of each sort.

These four answers arise from so many various ways of linking the rates of the ingredients together, which might have been prosecuted further.

To find the first answer, link the 16 and 4, and the 12 and 8 together; to get the second, link the 16 and 8, and the 12 and 4, together; to get the third, link as in the last, and then link the 16 and 4, together; to get the fourth answer, link as in the first; and then, the 16 and 8, and the 12 and 4.

CASE III.

When one of the ingredients is limited to a certain quantity; to find the several quantities of the rest, in proportion to the quantity given.

RULE.

1. Take the difference between each price and the mean rate, as in the last rule; then

2. Say, As the difference standing against the simple whose quantity is given—is to the known quantity—so is each of the other differences severally, to the several quantities required.

EXAMPLE FOR ILLUSTRATION.

1. Suppose a farmer mixes 20 bushels of wheat, at 12s. per bushel, with rye, at 8s. barley at 6s. and oats at 3s. per bushel; how much rye, barley, and oats, must be mixed with the 20 bushels of wheat, that the whole mixture be worth 5s. per bushel.

$$5\left\{\begin{array}{l}12\\8\\6\\3\end{array}\right. \quad \begin{array}{l}2\\2\\2\\7+3+1=11\end{array} \quad \begin{array}{r}2\\2\\2\\11\end{array}$$

As 2 : 20 :: 2
2

2)40

20 bushels at 8s.

As 2 : 20 :: 11
11

2)220

110 bushels at 3s.

Here I linked, and took the differences as before; and, then, stated it according to rule; saying, as 2 (that stands against the price of the wheat, whose quantity is given,) is to the quantity given, so is 2, that stands against the next simple, &c. this brought 20; so, there must be 20 bushels of rye. I omitted the next statement, as that would have been the same; the last statement brought 110, the quantity of oats; the whole answer stands thus: 20bu. of wheat, at 12s. 20bu. of rye, at 8s. 20bu. of barley, at 6s. and 110bu. of oats, at 3s.

EXAMPLES.

2. How much water must be mixed with 42 gallons of rum, worth 75cts. to reduce the price to 70cts? Ans. 3gals. of water.

Placed thus; $70\left\{\begin{array}{l}75\\0\end{array}\right.$ Observe the rule.

3. Suppose a merchant has 56 gallons of rum, at 10s. per gallon, which he would mix with some other rum at 8s. and some at 6s. with water, at 0s. per gallon; and so mixed, that the whole may be sold for 7s. per gallon; how much of each kind of rum, and how much water must the mixture consist of?

Ans. 8gals. at 8s. 8gals. at 6s. and 24gals. of water.

The answer is brought by linking the 10 and 0, and the 8 and 6, together; this question admits of a number of answers, by linking different ways.

CASE IV.

When the price of each simple is given; also, the mean rate and quantity to be compounded; to find how much of each sort will make that quantity.

RULE.

1. Place the difference between the mean rate, and the several prices, as before; then

2. Say, As the sum of these differences is to the whole quantity of mixture, so is each particular difference, to its particular quantity.

EXAMPLE FOR ILLUSTRATION.

1. Suppose a grocer has four sorts of tea, at the following prices; viz. at 1s. 2s. 6s. and 9s. per lb. which he would mix together, to make a composition of 96lbs. worth 3s. per lb. how much of each sort must he take?

```
   ┌1─┐ │ 6   as 12 : 96 :: 6      as 12 : 96 :: 3
3 {│2┐│ │ 3             6                       3
   │6┘│ │ 1            ——                      ——
   └9─┘ │ 2        12)576                  12)288
          —          ——                      ——
          12         48lbs. at 1s.           24lbs. at 2s.

  Proof.     as 12 : 96 :: 1          as 12 : 96 :: 2
48  at  1 s.             1                         2
24      2               —                        ——
 8      6          12)96                     12)192
16      9               —                        ——
—                        8lbs. at 6s,            16lbs. at 9s,
96
```

This question admits of a variety of answers; the above, perhaps, is sufficient.

2. How much gold, of 17, of 19, and of 23 carats fine, must be mixed together, to form a composition of 50oz. of 20 carats fine? Ans, 15oz. of 17 carats fine, 15oz. of 19; and 20oz. of 23 carats fine.

You will find the sum of the differences to be 10; the whole composition is 50oz. &c.

3. How much water, at 0 per gallon, must be mixed with rum at 80cts. per gallon, to fill a cask that holds 96 gals. which may be worth 50cts. per gallon? Ans. 36 gallons of water, and 60 gallons of rum.

A GENERAL RULE

FOR EXTRACTING THE ROOTS OF ALL POWERS.*

RULE.

1. Prepare the given number for extraction, by pointing off from the units place, as the required root directs.

2. Find the first figure by trial, and subtract its power from the left hand period of the given number.

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* For an explanation of powers, see Involution, p. 223.

3. Then, to the remainder bring down the first figure in the next period, and call it the dividend.

4. Involve the root into the next inferior power to that which is given, and multiply it by the index, or number, denoting the given power, for a divisor.

5. Find how many times the divisor is contained in the dividend, and annex the result to the root.

6. Involve all the root, thus found, into the given power.

7. Subtract the power, (always,) from as many periods of the given number, as you have found figures in the root.

8. To the remainder, bring down the first figure of the next period, for a new dividend.

9. Find a new divisor, as before, and, in like manner, proceed, till the whole is finished.

NOTE.—The extracting of roots of very high powers, by the rule, will be tedious. The following method, when practicable, will be found much more convenient, which is, by extracting the square and cube roots only. Thus, when any even power is given, extract the square root of it, which reduces it to half the given power; then, the square root of that power reduces it to half of the same power; and so on, till you come to a square or cube. For example; suppose a 12th power be given to extract the root of. The square root of that reduces it to a sixth power; and the square root of the sixth power reduces it to a cube the root of which may be extracted by the rules given.

EXAMPLE FOR ILLUSTRATION.

1. What is the sursolid or 5th root of 254803968? Ans. 48

$$254\dot{8}0396\dot{8}(48$$

$$4\times4\times4\times4\times4=1024 \text{ first subtrahend.}$$

$$4\times4\times4\times4\times5=1280)15240 \text{ first dividend.}$$

$$48\times48\times48\times48\times48=254803968 \text{ second subtrahend.}$$

$$0$$

As directed in the rule, I pointed off the given number into periods of five figures each, (it being the 5th root or power,) then I sought a root, whose power was nearest to the given number in the left hand period, (being less,) which I found to be 4, the power of which was 1024. This I subtracted from the first, or left hand period of the given number, and then brought down the first figure in the next period, which was 0; then, I proceeded, in the 4th place, to find a divisor; the rule says, involve the root to the next inferior power, &c. accordingly, I involved the 4 four times, and multiplied the product by 5, *the index of the* **given power**; this I called the divisor;

(Note, the first divisor will not always shew the true root: as in this case the divisor is contained in the number more than 8 times: but by trial it will be seen that the root is 8.) After placing 8, the root, in the quotient I involved the whole root, thus found, into the given power: this product I placed under the last, and the number coming like the given number, and there being no more periods to bring down, the work was done.

EXAMPLES.

2. What is the biquadrate or 4th root of 331776? Ans. 24

331776

Pay particular attention to the rule, and example for illustration: when you find the divisor, the root must be cubed, that being the next inferior power: then, multiply it by the index of the given power, which is 4.

3. What is the sursolid or 5th root of 7962624? Ans. 24

This is done like the first example.

4. What is the squared cube or 6th root of 782757789696? Ans. 96

Instead of working by the general rule, you may extract the square root of the given number; that will reduce it to half its power, or to a cube: observe, the square root of it will be 884736. Then, (by the general rule, if you please,) extract the cube root of that number, which will give 96, the answer.

5. What is the second sursolid, or 7th root of 587068342272? Ans. 48

Point off seven figures; then, find a figure whose power is nearest to the number in the left hand period, (being less,) and proceed as before.

Examples in the higher powers are not given, as the operation is tedious, and very seldom necessary.

SIMPLE INTEREST BY DECIMALS.

The following four letters may be observed, which, with their significations, are as follows:

P. the principal, or sum put to interest.
T. the time the principal continues at interest.
A. the amount, or principal and interest added together.
R. the ratio or the rate per cent.

Observe, the ratio is the simple interest of £1 or $1 for one year, at any given rate, and is thus found: as 100*l*, or 100D. is to the rate per cent. so is 1*l*. or 1D. to the ratio.

If the rate per cent. per annum be 6 dollars, then say, as 100D. : 6D. :: 1D. this gives .06, which is the ratio, and so with any rate per cent.

The following table is found in this manner:

A TABLE OF RATIOS.

Rate per cent	Ratio.	Rate per cent	Ratio.	Rate per cent	Ratio.	Rate per cent	Ratio.
2	.02	4½	.045	6½	.065	8½	.085
3	,03	5	.05	7	.07	9	.09
3½	.035	5½	.055	7½	.075	9½	.095
4	.04	6	.06	8	.08	10	.1

CASE I.

When the Principal, Time, and Rate per cent. are given, to find the amount.

RULE.

Multiply the principal by the ratio, and that product by the time, the last product will be the interest, to which add the principal for the amount.

Or thus: $PRT+P=A$.

Note.—Letters put together in this manner, without a sign between them, denote continual multiplication as may be seen in the rule above.

EXAMPLE FOR ILLUSTRATION.

1. What is the amount of 250 dollars, for 3 years, at 6 per cent. per annum? Ans. 295 dolls.

D.
250 Prin.
.06 Ratio
―――
15.00
3 Time
―――
45.00
250, Prin.
―――
295.00 Amt.

Here I multiplied (P.) the principal by (R.) the ratio; and then that product by (T.) the time; and lastly, I added (P.) the principal to the last product.

EXAMPLES.

2. What is the interest of 285£. 10s. for 6½ years, at 5 per cent. per annum? Ans. 378£. 5s. 9d.

Reduce the 10s. to a decimal, and annex it to the 280£. reduce the ½ to a decimal, and annex it to the 6yrs. and proceed according to rule.

3. What is the amount of 35D. 40cts. for 5¼ years, at 4½ per cent? Ans. 43D. 76cts. 3m. rem.

By the table you can see what the ratio of 4½ per cent. is .045.

Note.—If the time be months, reduce them to a decimal and proceed as before.

4. What is the amount of $480 for 9 months, at 6 per cent? Ans. 501D. 60cts.

Reduce the 9 months to a decimal and proceed.

5. What is the amount of 949 dolls. for 2 yrs. and 128 days, at 6 per cent? Ans. 1082D. 84cts. 8m. rem.

Find the decimal of 128 days, and annex it to the 2 yrs. and proceed as before.

6. What is the amount of 268£. 5s. for 7 mo. at 5¼ per cent? Ans. 276£. 9s. 3d. 2qr. rem.

You will find the decimal of 7mo. to be 5833 rem.

Note. The ratio of 5¼ per cent. is .0525.

7. What is the amount of 1000 dolls. for 4 yrs. and 139 days, at 6½ per cent? Ans. 1284D. 75cts. 3m. rem.

Find the decimal of the days, and annex it to the years, &c.

8. What is the interest of 3000 dolls. at 2½ per cent for 9 months? Ans. 56D. 25cts.

Work as before, and omit adding the principal to the last product.

TO CALCULATE INTEREST FOR DAYS.

RULE.

Multiply the principal by the given number of days, and that product by the ratio, divide the last product by 365 the number of days in a year, and it will give the interest required.

Or thus, $\frac{P\ R\ T}{365} = I$ the interest.

EXAMPLE FOR ILLUSTRATION.

1. What is the interest of 242£. 5s. for 120 days, at 6 per cent? Ans. 4£. 15s. 6d. 3.456 qrs.

£
242.25
06

14.5350
120

£.
365)1744.2000(4.7786
1460

2842 &c.

I first reduced the 5s. to a decimal, and annexed it to the 242L and then, multiplied by the ratio; this product I multiplied by the time; here, I have left the question for the learner to divide by the 365, &c. the quotient will be as in the margin; and, to find the proper quantity of the decimal, proceed as in case 3d, reduction of decimals.

EXAMPLES.

2. What is the interest of $280.40cts. for 80 days at 5 per ent. per annum? Ans. $3.07cts. 2m. rem.

3. What is the interest of 198D. 50cts. for 150 days, at 6 per cent. per annum? Ans. 4D. 89cts. 4m. rem.

4. What is the interest of 480£. 10s. for 30 days, at 4½ per cent. per annum? Ans. 1*l.* 15s. 6d. 2qrs. rem.

To calculate Interest on Cash Accounts, &c. when partial payments are made.

RULE.

1. Multiply the several balances by the number of days they are at interest.

2. Multiply the sum of these products by the ratio, and divide the last product by 365, and the quotient will be the whole interest due on the account.

EXAMPLE FOR ILLUSTRATION.

1. Suppose you lend Mr. James Merchant, 1000 dollars, as per bill on demand, dated November 16th. 1820, and received back as follows; Dec. 21st. 300 dolls; Jan. 30th 1821, 200 dolls.; April 18th, 300 dolls. and Nov. 16th, 200 dolls. How much interest is due on the bill at 6 per cent?

Ans. 23D. 83cts. 5m. rem.

Method of Operation.

		D.	Days.	Products.
Bill dated Nov. 16th, 1820;		1000	35	35000
Dec. 21, received		300		
	Balance,	700	40	28000
Jan. 30, 1821, received,		200		
	Balance,	500	80	40000
April 20, received,		300		
	Balance,	200	210	42000
Nov. 16, received principal in full,		200		
				145000
				06

```
365)870000(23 83 5
    730
    ----
    1400 &c.
```

By examining the above, you will see how it is performed; The 35 days is the time from Nov. 16, to Dec. 31; I multiplied the principal by the 35, and then subtracted the payment; the 40 days is the time from Dec. 21, to Jan. 30, &c. I multiplithe balance 700 dolls. by the 40 days, and then subtracted 200 dolls. the next payment; and in this manner I proceeded till I had found all the products, then added them into one sum, and multiplied by the ratio, and divided the last product by 365, this brought 23.835D. or 23D. 83cts. 5m. the interest required.

EXAMPLE.

2. Suppose you lend your friend 1500 dolls. on the 25th of November 1820, and receive of him the following sums, viz. Jan. 4th 1821, 500 dolls. March 14th 300 dolls. July 12th 400 dolls. and Nov. 25, the balance, 300 dolls. how much interest is due you, reckoning it at 6 per cent? Ans. 41D. 72cts. rem.

Proceed to find the sum of the products as in the last example, then multiply by the ratio and divide by 365 as before; try to find the number of days correctly.

Several methods for computing interest on notes, or obligations, having indorsements.

FIRST METHOD.

RULE.

1. Find the amount of the whole principal from the time the note was given, to the time of settlement,

2. Then find the interest on the payments separately, from the time they were paid, or indorsed, to the time of settlement; then find their amount; having done this, subtract the amount of the payments from the amount of the principal first found.

This manner of computing interest, on obligations of long standing, will be found to be erroneous, although it may differ but little for short periods of time; the reason why it is erroneous is, because the interest in a course of years will take from the debt and in time completely discharge it, without paying any of the principal.

EXAMPLE.

Suppose you have given your note for 500 dolls. at 6 per cent. per annum, and you pay 30 dollars, or the interest, justly due on it at the end of every year for 5 years. Now, at the end of this time, you must certainly be indebted 500 dollars, for you have paid nothing more than the yearly interest, due on said note. But according to the method here treated of, the result will be as follows:

The Note,	$ 500	1st payment,	$ 30.00
Int. for 5 yrs.	150	Int. for 4 yrs.	7.20
Am't of the note,	650	Amount,	$ 37.20
Am't of the payments	168		
		2nd payment,	30.00
Balance due,	$ 482	Int. for 3 years,	5.40
Amount of 1st payment,	$ 37.20	Amount,	35.40
of 2nd.	35.40		
of 3d,	33.60	3d payment,	30.00
of 4th,	31.80	Int. for 2 years,	3.60
Int. for the last year,	30.00		
		Amount,	33.60
Amount of payments,	168.00		
		4th payment,	30.00
		Int. for 1 year,	1.80
		Amount,	31.80

On this note there are 4 indorsemnts, upon which interest is claimed, the first for 4 years; the second for 3; the third for 2; and the fourth for 1 year. On the note there are 5 years interest, the amount of which is $650; the amount of payments, $168; this deducted from the $650, leaves $482 due on the note by this method; although you have paid no more than simply the interest due on it; so that you will perceive that had this note stood for a course of years, it would have been discharged without paying any of the principal.

EXAMPLE.

$750 New York, August 11th, 1824.

On demand, I promise to pay John Lender, the sum of seven hundred and fifty dollars with interest, at six per cent. per annum, for value received.

ISAAC BORROW.

Indorsements on the above note as follows, February 11th, 1826, $300. November 26th, 1826, $200. July 16th, 1829, $250. How much is due on said note August 16th, 1830?

Ans. $128.43cts.

First, find the amount of $750, from Aug. 11, 1824 to Aug. 16, 1830, (the time being 6yrs. 5 days,) and place it as in the illustration; then, find the am't of the 1st payment, from Feb. 11, 1826, to Aug. 16, 1830, (4yrs. 6m. 5d.) then, find the amount of the 2d payment, from the time of the payment to the time of the settlement; (3yrs. 8mo. 21 days.) Find the amount of the 3d payment, for the time, (1yr. 1mo.) add the amount of the three payments together and subtract their sum from the amount of the note, the remainder will be the balance due; the learner may find the time, and see if the calculation is right. Observe. The amount of the first *payment is* $381.24cts. of the second 244D. 69cts. and of the *third, 266D. 25cts.*

SECOND METHOD.

The following was established as a standing rule, by the superior court of the State of Connecticut, in 1784, for computing interest on notes or obligations, as before stated:

RULE.

Compute the interest to the time of the first payment; if that be one year or more, from the time the interest commenced, add it to the principal, and deduct the payment from the sum total. If there be after payments made, compute the interest on the balance due, to the next payment; and, then, deduct the payment, as above; and, in like manner, from one payment to another, till all the payments are absorbed; provided, the time between one payment and another, be one year, or more. But if any payment be made before one year's interest hath accrued, then, compute the interest on the principal sum due on the obligation for one year; add it to the principal, and compute the interest on the sum paid, from the time it was paid, up to the end of the year; add it to the sum paid, and deduct that sum from the principal and interest added, as before.

If any payments be made, of a less sum than the interest arisen at the time of such payment, no interest is to be computed, but only on the principal sum for any period.

EXAMPLE.

A note, dated August 11th, 1824, given for $750, at 6 per cent. per annum, (as in the last example,) and the indorsements as follows: February 11th, 1826, $300; November 26th, 1826, $200; July 16th, 1829, $250; how much is due on said note, August 16th, 1830? Ans. $156

METHOD OF OPERATION.

Note, dolls. 750.00

Interest up to first payment, it being 1 year, 6 months,

Amount,

1 payment,

new principal,

Interest for 1 year, (a payment having been made before 1 year's interest had accrued,)

2d payment, dolls. 200.00

Int. to end of the year, it being 2 months, 16 days, 2.52

202.52 202.52

new principal,

In[illegible] 3d payment, it being 2 yrs. 5mo. 5 days,

Amount,
3d payment, 250.00

new principal,
Int. up to time of settlement, it being 1yr. 1mo.

Due on the note, according to this method, dolls. 156.00

Note, the second payment being made before one year's interest had accrued, the interest, according to rule, must be computed on the principal sum, (or new principal,) for 1 year; that is, from February 11th, 1816, the time of the last payment, to February 11th, 1817, which is 2 months, 16 days; this interest add to the payment, and then subtract it from the principal added above.

The operation I have left for the learner to work out. Although I have put down the time, it will be better for him to find it.

THIRD METHOD.

The courts of law, in Massachusetts, established the following rule for computing interest on notes, &c. on which partial payments have been indorsed:

RULE.

Compute the interest on the principal sum, from the time when the interest commenced, to the first time when a payment was made, which exceeds, either alone or in conjunction with the preceding payment, (if any,) the interest at that time due; add that interest to the principal, and,from the sum, subtract the payment made at that time, together with the preceding payment, (if any,) and the remainder forms a new principal, on which compute and subtract the payments, as upon the first principal, and proceed in this manner, to the time of final settlement.

EXAMPLE.

The example the same as before, viz. a note dated August 11th, 1824, given for $750 at 6 per cent. per annum. Indorsements as follows: February 11th, 1826, $300; November 26th, 1826, $200; July 16th, 1829, $250; how much is due on this note, August 16th, 1830? Ans. $155.68cts.

METHOD OF OPERATION.

Note, Dolls. 750.00
Interest up to first payment, it being 1 year, 6 months,

Amount,
first payment, 300.00

new principal,
Interest up to 2d payment, it being 9 mo. 15 days,

Amount,
2d payment, 20

	new principal,	
Interest up to 3d payment, it being 2yrs. 7mo. 20 days,		
	Amount,	
	3d payment,	250.00
	new principal,	
Interest up to time of settlement, it being 1 year, 1 month,		
Due on the note, according to this method,		Dolls. 155.68

The following is the balance due by each method, as exemplified in the examples.

Due, according to the first method,		Dolls. 128.43 cts
do.	the second,	156.00
do.	the third,	155.68

Annuities, Pensions, &c, in Arrears at Simple Interest.

Note. An annuity is a yearly income arising from money, &c. and is payable yearly, for a certain number of years, or for life, and when a person keeps the annuity in his own hands beyond the time of payment, it is said to be in arrears.

The sum of the annuities for the time they have been forborne, together with the interest due on each, is called the amount.

If an annuity is bought off, or paid for, all at once at the commencement of the time, the price paid is called the present worth. Annuities are generally payable or due, either yearly, half yearly, or quarterly.

Here, let A, represent the amount; R, the ratio of rate per cent. and T, the time as before. Note, U, represents the annuity.

RULE.

$$\frac{T\ U\ T - T\ U}{2} \times R + T\ U = A$$

That is, time mult. by the ann. mult. by time, less the time and ann. The result divided by 2, and the quotient mult. by the ratio, to which add time and ann. the sum is equal to the amount.

EXAMPLES.

1. If an annuity of 80£ be forborne 5 years, what will be due for principal and interest, at the end of said term, simple interest, being computed at 6 per cent. per annum? Ans. £448

$\overset{T}{5}\times\overset{U}{80}\times\overset{T}{5}-\overset{TU}{400}\div 2\times\overset{R}{.06}+\overset{TU}{400}=\overset{£}{448}$ the amount,

Ohs— is the time and annuity multiplied together. From the

ove, I think the learner may find the result of the fol

2. Suppose a house be let upon a lease of 8 years, at $ 200 per annum, and the rent be in arrears for the whole term; what is due at the end of said term; simple interest being allowed, at 5 per cent. per annum? Ans. 1880 Dolls,

Note, when the annuity, &c. is to be paid half yearly or quarterly, then for half yearly payments, take half of the ratio, half the annuity, &c. and twice the number of years; that is, reduce the years to half years—and for quarterly payments, take a fourth part of the ratio, and a fourth part of the annuity, and four times the number of years, and work as before.

3. If a salary of 100£, payable every half year, remains unpaid for 5 years, what will it amount to in that time, at 6 per cent. per annum? Ans. 567£ 10s.

Half the ratio will be .03; half the annuity, 50; the number of half years, 10; work as before.

4. If the payment of a pension, due quarterly, be omitted to be paid for 5 years, what will it amount to in that time, if 5 per cent. be allowed to a person who has a pension of $200? Ans. $1118.75cts.

The fourth part of the ratio will be .0125, for that is the fourth of .05; the ann. 50; and the quarter years, 20; proceed as before.

PRESENT WORTH OF ANNUITIES.

Here, P represents the present worth, U T and R as before.

To find the present worth of an annuity, at simple interest. Given, U, annuity; T, time; and R, ratio; to find P, present worth.

RULE.

$$\frac{R\ T\ T - R\ T + 2\ T}{2\ R\ T + 2} : \times U = P$$

EXAMPLES.

1. How much present money is equal to an annuity of $ 200, to continue 5 years, at 6 per cent.? Ans. 861D. 53cts. 8m.

$$\overset{R}{.06} \times \overset{T}{5} \times \overset{T}{5} - \overset{RT}{30} + \overset{2T}{10} = 11.20$$ the dividend. $.06 \times 5 \times 2 + 2 = 2.60$ the divisor; divide the dividend by this divisor, and multiply the quotient (4.30769) by (200) the annuity, the product will be the answer.

2. What is the present worth of 60£ per annum, to continue 4 years, at 5 per cent.? Ans. 214£ 19s. 11d. 3qrs.+

Note.—The same is to be observed here for half yearly and quarterly payments, as mentioned in the last rule.

3. What is a pension of 250 dolls. per ann. worth, in ready money, payable half yearly, at 6 per cent. for 5 years? Ans. 1091dolls. 34cts. 6m.+

Take half the ratio; half the pension; and double the years; and proceed according to rule.

4. What is the present worth of a pension of 60dolls. per annum, payable quarterly, for 5 years, at 6 per cent?

Ans. 263dolls. 65cts. 3m.+

Take the fourth of the ratio; one fourth of the annuity; and 4 times the number of years, &c.

* * *

COMPOUND INTEREST.

The following letters are made use of, viz. A, the amount; P, the principal; T, the time; R, the ratio or the amount of 1£ or $1, for a year; and is found by the following proportion: as 100 : 105 :: 1 :: 105, ratio at 5 per cent. or, As 100 : 106 : 1 : 1.06, ratio at 6 per cent. &c.

Table of the amounts of 1£ for a year.

Rate per cent	Am't of 1£ or $1	Rate per cent	Am't. of 1£ or $1	Rate per cent	Am't of 1*l*. or 1D.	Rate p c'nt	Amt' of 1*l*. or 1D.
2	1.02	4½	1.045	6½	1.065	8½	1.085
3	1.03	5	1.05	7	1.07	9	1.09
3½	1 035	5½	1.055	7½	1.075	9½	1.095
4	1.04	6	1.06	8	1.08	10	1.1

When P T and R are given to find A.

RULE.

$$P \times R^{T} = A$$

The rule explained, is thus; P, principal, multiplied by the ratio involved so many times, as the number of years direct is equal to the amount.

NOTE.—Subtract the principal from the amount, the remainder will be the compound interest.

EXAMPLE FOR ILLUSTRATION.

1. What is the amount of 500 dollars, for 4 years, at 6 per cent.?

Ans. 631D. 23cts. 8m.+

According to the rule, the ratio must be involved into the time, and that product multiplied by the principal, as follows:

R R R R P D. D. cts. m.
1.06×1.06×1.06×1.06=1.26247696×500=631.23848000=631.23 8+

Observe, When the time is 4 years involve the ratio 4 times; when 5 years, 5 times, &c.

2. What is the amount of 248*l*. 10s. for 5 years, at 5 per cent. per annum?

Ans. 317*l*. 3s. 1d. 1qr. and rem

Proceed according to rule, and involve the ratio 1.05, five times and mult. by the principal; mind and reduce the 10s. to

3. What will 748dolls. 50cts. amount to, in 4 years, at $6\frac{1}{2}$ per cent. per annum? Ans. 962dolls. 92cts, and rem.

4. What is the compound interest of 250 dollars, for 6 years, at 7 per cent. per annum? Ans. 125dolls. 18cts. 2m. and rem.

Find the amount, from which subtract the principal, for the compound interest.

Annuities, Pensions, &c. in arrears, at compound interest.

In the following rule, U, represents the annuity, pension, or yearly rent; A, R and T, as before.

When U T and R, are given, to find A.

RULE.

$$\frac{UR^{T}-U}{R-1}=A$$

The above is multiplied by R involved into the time less U, and the remainder divided by R less 1, is equal to the amount.

EXAMPLES.

1. What will an annuity of 200dolls. per annum, payable yearly, amount to in 4 years, at 6 per cent?

Ans. 874D. 92cts. 3m. and rem.

1.06×1.06×1.06×200—200=52.49539200 for a dividend, 1.06—1 for divisor; divide, and the quotient will be the amount.

2. What is the amount of a salary of 50*l.* to be paid yearly, if it be forborne, or unpaid, for 5 years, at 5 per cent. per annum?

Ans. 276*l.* 5s. 7d. 2.3qrs.

Present worth of Annuities, &c. at compound interest.

P, represents the present worth; U T and R, as before.

When U R and T are given, to find P.

RULE.

$$U-\frac{U}{R^{T}}:\div R-1=P$$

Explanation of the rule U divided by R involved into T, the quotient subtracted from U, and the remainder divided by R less 1 will give P.

EXAMPLES.

1. What is the present worth of an annuity of 100dolls. per nnum, to continue 3 years at 5 per cent? Ans. 272D. 32cts. 6m.

R R R U
05×1.05×1.05=1.157625 the divisor; then, 100÷1.157625=86.3837; tly, 100—86.3837÷05 (ratio less 1) the quotient will be the answer.

2. What is the present worth of an annuity, or yearly ren 200dolls. to continue 6 years, at 6 per cent?

Ans. 983D. 46cts. 4m.

Involve R 6 times, and proceed as before.

7

3. What is the present worth of a pension of 750dolls. per annum, for 4 years, at 5 per cent? Ans. $2659.46cts. 2m. -/-

QUESTIONS FOR EXERCISE,

In most of the foregoing rules, placed promiscuously.

1. What is the sum of 948$\frac{3}{4}$, added to one third of itself? Ans. 1265.

2. What is the difference between twice five and thirty, and twice thirty-five? Ans. 30

3. If 4 and 8 make 14, how many will 9 and 10 make? Ans. 22$\frac{1}{6}$

4. Divide one twelfth of 1956£. 18s. into eleven parts; and if my share is one fifth of the last quotient, tell me what it is? Ans. 2£. 19s. 3d. 2qr. $\frac{2}{5}$

5. Suppose your grandfather, (if living,) to be 80 years of age; your father 62; you are not so old as your grandfather by 42 years; what is the difference in years, between your father and you? Ans. 24 years.

6. Eighty-five multiplied by sixty-three, will produce a certain number; now, what number multiplied by thirty-six, will produce just the same? Ans. 148.75

7. What is the difference between the square of 625, and the square root of the same number? Ans. 390600

8. If 5 oranges are worth 12 limes, and 3 limes cost 2cts. what will be the price of 6 dozen oranges? Ans. 1D. 15cts. 2m.

9. If 2000 dolls. bank stock be purchased, at 102$\frac{3}{8}$ per cent. what does it come to? Ans. 2047D. 50cts.

10. What is the difference between the interest of 1000D. at 6 per cent. for 18 months, and the discount of the same sum, at the same rate and time? Ans. 7D. 43cts. 2m. rem.

11. What is the difference in the content of a cubic bin, or box, that measures 6 feet every way, and another that measures 3 feet every way? Ans. 189 feet.

12. If I sell cloth for 2$\frac{3}{4}$ dolls. per yd. and lose 20 per cent. by the sale of it, how much did it cost? Ans. 3D. 43cts. 7$\frac{1}{2}$m.

13. If a captain, and 105 sailors take a prize worth 9000D. and the captain takes $\frac{1}{6}$ for his share; and the remainder be divided equally among the sailors; what is the share of each? Ans. The captain must have 1500 dollars, and the share of each sailor is 71D. 42cts. 8m. rem.

14. What is the difference, and what the sum of, six dozen dozen, and a half a dozen dozen? Ans. Their difference is 792, and their sum 936.

15. Suppose a grocer mixes 2cwt. of sugar, worth 10 dolls. 50cts. per cwt. 3 cwt. worth $9\frac{1}{4}$ dolls. 1 cwt. worth $11\frac{3}{4}$ dolls. together, what is the value of 1lb. of this mixture?

Ans. $9\frac{1}{336}$cts.

16. If two men, O. and P. trade in company, O. puts in 630 dolls, and takes $\frac{5}{9}$ of the gain; how much did P. put in?

Ans. 504 dolls.

17. If 40 men can perform a piece of work in 17 days, how many men can accomplish another five times as large, in a fourth part of the time? Ans. 800 men.

18. There is a number, which, if multiplied by $\frac{2}{3}$ of $\frac{4}{5}$ of $3\frac{1}{3}$, will produce no more than 1, what is the square of that number? Ans. $\frac{81}{256}$.

19. How many stones $1\frac{1}{2}$ feet long $\frac{4}{5}$ of a foot broad, and $\frac{2}{3}$ of a foot thick, are equal to 60 stones $2\frac{3}{4}$ feet long, $1\frac{1}{2}$ feet broad, and $1\frac{1}{5}$ feet thick? Ans. $371\frac{1}{4}$ stones.

20. If A. B. and C. have gained 1000 dolls. what is each man's share, suppposing B. to have 10 per cent. more than A. and C. 20 per cent. more than B.

Ans. A's. share is 292D. 39cts. 7m. $\frac{226}{342}$; B's. 321D.63cts. 7m. $\frac{146}{342}$; and C's. 385D. 96cts. 4m. $\frac{312}{342}$.

21. What is the continued product of $\frac{9}{10}$, $\frac{5}{2}$, and $\frac{4}{9}$?

Ans. 1.

22. If a farmer has 60 hogs in his pen fatting, and finds that he has corn enough to keep them only 20 days; but wishing to keep them 50 days; the question is, how many must be turned out, that the corn may last the remainder that time?

Ans. 36.

23. Suppose that a wall, that is 56 feet from the foundation be $\frac{1}{2}$ of $\frac{2}{7}$ under ground $\frac{3}{4}$ of $\frac{1}{7}$ under water; how much of it is visible? Ans. 42 feet.

24. Suppose that I am dispatched with a commission from New York, to a place 600 miles distant, and my rate of travelling is settled at 25 miles per day, and you five days after, are sent with fresh orders, and travel 35 miles a day; whereabouts on the road will you overtake me.

Ans. You would have to travel $437\frac{1}{2}$ miles to overtake me; consequently, I should be $162\frac{1}{2}$ miles short of my journey's end.

25. If I buy stockings in New York at 6s. per pair, and afterwards sell them again in Boston, at 7s. the pair, and sup

sing the charges to have been upon an average 3D. per pair; what is the gain per cent? Ans. $12\frac{1}{2}$£. per cent.

26. If Emeline receives 600 dollars for her portion, and this sum is $\frac{2}{5}$ of $\frac{3}{11}$ of her brother's, and $2\frac{1}{5}$ of her brother's portion is $\frac{4}{5}$ of her father's estate; how much was he worth?

Ans. 15125 dolls.

27. If a merchant buys 14 puncheons of 4th proof rum, containing 102 gallons each, which cost 1 doll. $12\frac{1}{2}$cts. per gallon, and he proceeds to reduce the same, by putting 1 gallon of water to $3\frac{1}{2}$ of rum, (for upon examination he finds that it it will bear that and no more,) after reducing it, he sells the whole at 98cts. per gallon; what is the profit on the whole?

Ans. 192D. 78cents.

28. Suppose 2 men hire a coach, to go from New York, to a certain place 60 miles distant for 20 dolls. and after they had proceeded 25 miles, they take in two men, upon condition of their paying proportionably; how much must each pay?

Ans. { The first two, each, 6D. 31cts. 5m. $\frac{150}{190}$.
{ The last two, each, 3D. 68cts. 4m. $\frac{40}{190}$.

29. If I buy a farm for 3500 dolls. one half of the purchase money I pay down, and for the other half I give my note, payable in 2 years with interest at 6 per cent. and after it has stood 8 months, I propose paying it off, provided the holder of it will allow six per cent. discount on the amount of the note, for the remainder of the time which he agrees to; what will I have to pay? Ans. \$1685.18cts. 5m. rem.

30, Suppose that a ladder standing upright should just reach the eaves of a house, known to be 40 feet high, and a person slide the bottom or foot of the ladder 14 feet from the side of the house; the question is, how many feet did the top of the ladder fall or move down from the eaves by the movement.

Ans. 2.531 + feet.

31. If I have an orchard of fruit trees, one half of which is winter apples; one fourth summer apples; one twelfth peach; one fifteenth pear; one twentieth cherry; and 30 plum trees; how many are there in the orchard, and how many of each kind? Ans. 600 in the orchard, of these, 300 are winter apples, 150 summer apple, 50 peach, 40 pear, 30 cherry and 30 plum trees.

32. What is that number which, being multiplied by 33, the product will be $\frac{11}{13}$. Ans. $\frac{1}{39}$.

33. If I buy 240 barrels of apples, for 3 dolls. 25cts. per barrel, upon a credit of 8 months, and after overhauling them, lling out those that were defected, which amounted to 5

barrels, I sold the remainder for 4 dolls. 20cts. the barrel, payable in 10 months; what is the gain or loss per cent. reckoning 6 per cent. for the present worth of both the buying, and selling price? Ans. Gained 25D. 33$\frac{1}{3}$cts. per cent.

34. If a person's income is 400£. New York currency a year, how much may he expend daily in support of his family, to lay up enough to buy 145 acres of new land, at 4 dolls. 75cts. per acre? Ans. 85cts. 2m. $\frac{270}{365}$.

35. If George and Benjamin trade together, and gain 600 dolls. George puts in 1000 dolls. Benjamin puts in so much that he must have 350 dolls. of the gain; how much did Benjamin put in. Ans. 1400 dolls.

36. If William owns $\frac{5}{8}$ of $\frac{4}{5}$ of $\frac{9}{10}$ of a ship and cargo worth 10840 dolls. and he sells his brother David $\frac{5}{9}$ of $\frac{4}{10}$ of his part; what was the value of William's part; what does David's part come to, and what will their Uncle Isaac have to pay for $\frac{3}{11}$ of the remaining part of the ship and cargo. Ans. William's part is 4878 dolls. David's part comes to 1084 dolls. and their Uncle Isaac's, to 1626 dolls.

37. Suppose a person buys 12 hhds. of sugar at New Orleans, the weight of the casks upon an average, being 8C. 3qrs. 14lbs. tare per hhd. 59lbs. and he ships the same for New York, agreeing to pay 2 cents per lb. freight, besides $\frac{1}{4}$ of a cent per lb. to the captain for his extra service, of seeing the sugar stored, on arriving at New York; after said sugar had arrived, and been stored 4 months, the cost of which was 12$\frac{1}{2}$cts. per C. per month; the owner sells it at 10$\frac{1}{4}$dolls. per C. what is the gain on the whole, after deducting 7 dolls. for sundry expences such as carting, &c. supposing that the sugar cost 5$\frac{3}{4}$ dolls. per C. in New Orleans. Ans. The gain is 141D. 26cts. 5m.

38. The ages of my two son's are as follows: one is 5, and the other is 10 years of age; now, how must 1200 dolls. be divided between them, so that it may amount to equal sums at 6 per cent, simple interest, when they shall be respectively 21 years of age. Ans. The eldest must have 649$\frac{131}{181}$ dolls. the youngest 550 $\frac{50}{181}$ dolls.

39. If to my age there added be,
One half, one third, and half of three;
Three score one tenth, the sum, you'll see,
What is my age come show to me?
I write the answer, 33.

40. If a person, for a sum of money, agrees to travel 100 rods and return to the place he started from, at the end o rod, how far has he to travel to perform the task; and

whole distance is to be travelled in 5 hours; how many miles an hour is it? Ans. The distance is 31M. 4F. 20R. and the rate of travelling is 6M. 2F. 20R.

41. There are two numbers, whose dividend is the number of inches in a solid foot, the quotient the square of 8; what is the divisor and the difference between the cube of the quotient, and the sum of the squares of the divisor and dividend.

Ans. Divisor 27, and the difference 2724569

42. If in a naval engagement, there is ¼ of the men killed ⅕ wounded, one tenth driven overboard, and drowned, and the remainder, fit for duty, amounts to 306 men; how many were there on board, how many killed, and how many wounded, and how many drowned? Ans. 680 on board, 170 killed, 136 wounded, and 68 drowned.

43. If out of 4 dolls. per week I lay up 15cts. per day, (sundays excepted,) and have saved 46 dolls. 95cts. how long was I laying it up, and how much have I spent in the time?

Ans. 365 days or 1 year in laying up, and spent $161.05cts.

44. Suppose that during the ebb tide, a boat should set out from the battery at New York, for Sandy Hook; taking the distance at 27½ miles, and at the same instant another should set out from Sandy Hook, for New York; the current forwards the one, and retards the other, say 2¾ miles an hour; suppose the boats to be equally laden, and the rowers equally good, and in the ordinary rate of rowing in still water, would proceed 5¼ miles an hour, the question is whereabouts in the river would the boats meet?

Ans. They would meet 20.625 miles from New York, and 6.875 miles from Sandy Hook.

45. If a gentleman purchase a span of horses with a harness, the whole of which cost 500 dolls. the harness, if laid on the first horse, then both will be of equal value; but, if the harness be put on the other horse, he will be worth double of the first; how much did the horses and harness cost?

Ans. The first horse cost 166⅔ dolls. the harness 83⅓D. and the second horse 250 dollars.

46. If a person sells oranges at 50s. per hundred, and thereby clears ⅖ of the money; but the season getting advanced and oranges growing scarce, he raised them to 57s. per hundred; what may he clear per cent. by the last mentioned price?

Ans. 90£. per cent.

is the interest of $25000 for 1 hour at 6 per cent.

Ans. 17cts. 1m. rem,

48. If a merchant buys two dozen pieces of muslin, for four times as many pounds, and sells them again for five times as much; but had they cost as much as they were sold for, what must they have been sold for to have gained at the same rate? Ans. 150£.

49. Suppose a merchant buys a quantity of rum and brandy, the whole of which costs 208 dolls. the quantity of rum 80 gallons, at 85cts. per gallon; and for every 5 gallons of rum there were 7 gallons of brandy; how many gallons of brandy were there, and how much per gallon?

Ans. 112 gals. of brandy, at 1D. 25cts. per gal.

50. Suppose a man pretty well acquainted with numbers, should agree to work in a nail factory for one year, and to receive for his labour, barely 1 nail for the first week, 2 nails for the second, 4 for the third, &c. doubling each week to the end of the year; what does his wages amount to, supposing it takes 80 nails to make a pound, and the whole quantity to be sold for 8cts. per lb? Ans. 4503599627370D. 48cts. rem.

51. Suppose Leonard, Abraham and Samuel, trade together; Leonard puts in a certain sum; Abraham puts in 247 pieces of muslin; Samuel puts in 650 dolls. and they have gained 725 dolls. whereof Leonard ought to have 220 dolls. and Abraham, 305; what is Samuel's share; what did Leonard put in, and what was the 247 pieces of muslin worth.

Ans. Samuel's share is 200 dolls. Leonard laid in 715D.
and Abraham's muslin was worth $991.25cts.

52. Find the number whose half being divided by 12, its $\frac{1}{3}$, by 8, its $\frac{1}{4}$ by 6, and its $\frac{1}{6}$ by 4; and each quotient shall be 9. Ans. 216

53. Suppose I have purchased a farm for 3600 dolls. and the accounts stand thus; one third of the purchase money I paid down, one third was to be paid in 18 months, with the interest from the date, at 6 per cent. and the other third was to be paid 12 months after the payment of the second, but no interest allowed; now at the end of 18 months, how much have I to pay in all, if I settle the account; supposing that I am allowed 6 per cent. discount on the last payment for the 12 months.

Ans. 2440 dolls. 07cts. 5m. $\frac{25}{53}$,

54. As I was beating on the forest grounds,
Up starts a hare before my two greyhounds;
The dogs being light of foot did fairly run,
Unto her fifteen rods just twenty-one;
The distance that she started up before,
Was fourscore sixteen rods just and no more;
Now this I'd have you, unto me declare,
How far they ran before they caught the hare?
Ans. The dogs ran 336 rods, and the hare 240 rods.

55. If 600lbs. of beef serve 210 men 6 days, how many lbs. will serve 450 men 5 weeks? Ans. 7500

56. If John can build a boat alone in 5 days; David in 10 days; Nathan in 20 days, and Charles in 40 days; how long would it take them to build a boat, if all worked together? Ans. $2\frac{2}{3}$ days.

57. Suppose I have an orchard consisting of 3600 trees, the rows being 16 feet a part one way, and 12 feet the other, in a rectangular lot of ground; how much land does the orchard take up? Ans. 15.8677 + acres, or 15A. 3R. 18.8 + P.

58. Suppose that it is between 4 and 5 o'clock, and the minute hand, and hour hand are both together; what o'clock is it? Ans. $21\frac{9}{11}$ min. past 4.

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MISCELLANEOUS.

OF LEVERS.

There being three orders of levers, or three varieties, wherein the weight, prop, or moving power, may be differently applied to the vectis or inflexible bar, in order to effect mechanical operations in a convenient manner.

A lever of the first order has the power at one of its ends, and the weight to be raised put at the other; and the fulcrum or prop, somewhere between them.

Observe. In this order, the power applied at one end, will be reciprocally proportional to the distance of those ends from the fulcrum, or point supported, or in the steelyards, as the distance of the weight from the point of suspension.

EXAMPLES.

1 will a person be able to raise, who presses the force of 160lbs. on the end of an equiong, which has a convenient prop exactly 10 er end of the bar? Ans. 14C.

From the length of the bar 108 inch, take the length of the prop from the end of the bar, viz. 10 inches; then state it, making the remainder the first term, the weight (160lbs.) the second, and the 10 inches the third; performed by inverse proportion.

2. What weight hung 7 feet from the fulcrum of a steelyard will equipoise a hogshead of sugar that weighs 8C. it being freely suspended at 3 inches distant from the other end?

Ans. 32lbs.

Stated thus; 3in. : 8C. :: 7ft. by inverse proportion.

In mechanism, a lever of the second order is where the power acts at one end; the prop fixed directly at the other end, and the weight somewhere between them.

In this order of levers, their force is in contra proportion to their length.

EXAMPLES.

1. If a lever be 9 feet long, what weight lying 10 inches from the end resting on the ground, may be moved with the force of 160lbs. lifting at the other end of the lever? Ans. 1728lbs.

Stated thus; 10in. : 160lbs. :: 9in. done by the Rule of Three Direct.

A lever of the third order, is when the prop is planted at one end of the bar, the weight at the other, and the moving force somewhere between them.

EFFECTS OF LIGHT, HEAT, AND ATTRACTION.

Observe. The effects of light, heat and attraction, are reciprocally proportional to the square of their distance from the centre whence they are propagated.

EXAMPLES.

1. Suppose that Solomon and Seth sit in a room where there is a fire, from which Solomon is 4 feet, and Seth 8 feet distant; now, how much hotter is it at Solomon's seat than at Seth's?

Ans. 4 times hotter at Solomon's.

Square each distance, and the proportion of their products will be the answer; thus, as the square of the greater distance is to 1, so is the square of the lesser distance, &c. by inverse proportion.

2. Suppose a body is placed 8 feet from a source of heat, and it becomes necessary that it should receive double the heat it does at that place, at what distance must it be placed to receive the required heat? Ans. 5,6568+ feet.

Square the distance, and say, as 1 is to the square found, so is 2 to the square of the required distance; performed by inverse proportion; extract the square root of the number found, and it will be the answer.

VIBRATION OF PENDULUMS.

By experiment, it has been found, that a pendulum 39.2
long, *vibrates 60 times* in one minute, and the length

dulums are reciprocally as the square of the number of thei vibrations, made in the same space of time.

EXAMPLES.

1. Give the length of a pendulum that will vibrate 120 time in a minute. Ans. 9.8 inche

A pendulum that vibrates seconds, will make 60 vibrations in a minute accordingly, say, as the square of 60 is to the length of the pendulum (39.2) so is the square of 120, the given number, to the length of th pendulum required. Inverse proportion.

2. Give the length of a pendulum that will swing, or vibrate 30 times in a minute. Ans. 156.8 inches

The first and second terms as before, and the square of 30 for the thir term.

DIVERTING.

1. Suppose a loaf of sugar weighs 11lbs. in one scale, bu being put into another, it weighs only 8lbs. what is the tru weight? Ans. 8lbs. 2.3oz

Rule. Multiply the two weights together, and extract the square roo of the product; said root will be the true weight.

2. Suppose you wish 4 weights made so that you can weig any number of pounds, from 1 to 40; what must be the weigh of each? Ans. 1lb. 3lbs. 9lbs. and 27lbs

Rule. To double of the first or least weight, (which is 1 pound,) ad 1, and it gives the second weight; then; to double the weight of thes two weights, add 1, and you have the third weight; and to double th sum of these three weights add 1, and it will be the fourth weight.

3. If the reckoning of a certain company amount to 9s. 2¼d and the number of persons be equal to the farthings each spent how many were there in the company, and how much did each spend? Ans. 21 men, and each spent 5¼d.

Rule. Reduce the given sum to the lowest name mentioned; and the square root of that number will be the answer.

Rules for finding the contents of Superficies and Solids.

SUPERFICIAL MEASURE.

The superficial area, or content of any plane surface, is considered to be divided into squares, which is either greater or less, according to the different measures by which they are taken. If taken in feet, we say, the number of square feet; i taken in inches, the square inches, &c. Thus suppose a board measures 1 foot, or 12 inches, upon each side; then, 12×12= inch in a superficial foot.

'o find the content of a square, having equal sides, o or long square.

RULE. Multiply the length by the breadth, and the product will be the superficial content.

The content of an oblong is found in the same manner only, the perpendicular breadth is taken, instead of measuring along the side or end.

PROBLEM 2. To find the area or content of a triangle.*

RULE. Multiply one of its sides by the perpendicular let fall from the opposite angle to that side, and half the product will be the content.

PROBLEM 3. When the sides of a triangle are given, to find the content.

RULE. From half the sum of the three sides, subtract each side severally; then, multiply that half sum and the three remainders together; and the square root of the last product will be the content of the triangle.

PROBLEM 4. To find the diameter, circumference, and content of a circle.

RULE I. To find the circumference of a circle, the diameter being given; say, as 7 is to 22, so is the given diameter to the circumference; or more exactly, as 113 is to 355, so is the diameter, &c.

RULE 2. To find the diameter, say, as 22 is to 7, so is the given circumference to the diameter; or, as 355 is to 133, so is the circumference, &c.

RULE 3. To find the content.—Multiply the square of the diameter by .7854, and the product will be the area; or, multiply half the diameter by half the circumference; and the product will be the area.

PROBLEM 5. To find the content of an ellipsis or oval.

RULE. Multiply the two diameters together, and then multiply that product by .7854, the last product will be the area.

MENSURATION OF SOLIDS.

The dimensions of solids are taken in inches, feet, &c. and are estimated by the solid foot, inch, &c. Note, a foot contains 1728 solid inches, and is called a cubic or solid foot.

PROBLEM 6. To find the content of a cube, &c. having six sides, or being a regular solid having three dimensions, viz. length, breadth, and thickness.

RULE. Multiply the breadth by the width or depth, and that product by the length; the last product will be the solid content; or multiply the content of the end or base by the length; and the product will be the content.

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* A triangle is a space included by three lines or sides.

PROBLEM 7. To find the content of a cylinder.*

RULE. Find the content of the base, or end, which is a circle. by rule 3d, under problem 4th; then multiply that content by the length; and the product will be the solid content required.

* A cylinder is a round solid, of equal bigness from end to end.

PROBLEM 8. To find how many solid feet a round stick of timber, (of equal size from end to end,) will contain, when hewn square.

RULE. Multiply twice the square of the semi-diameter, (or half diameter,) in inches by the length in feet, and divide the product by 144; the quotient will be the answer.

PROBLEM 9. To find how many square edged boards of equal thickness, can be sawn from a log of a given diameter.

RULE. Find the content of the log, when made square, by the last rule; then say, as the thickness of the board, including the saw-gap, is to the solid feet, so is 12 inches to the number of feet in the boards.

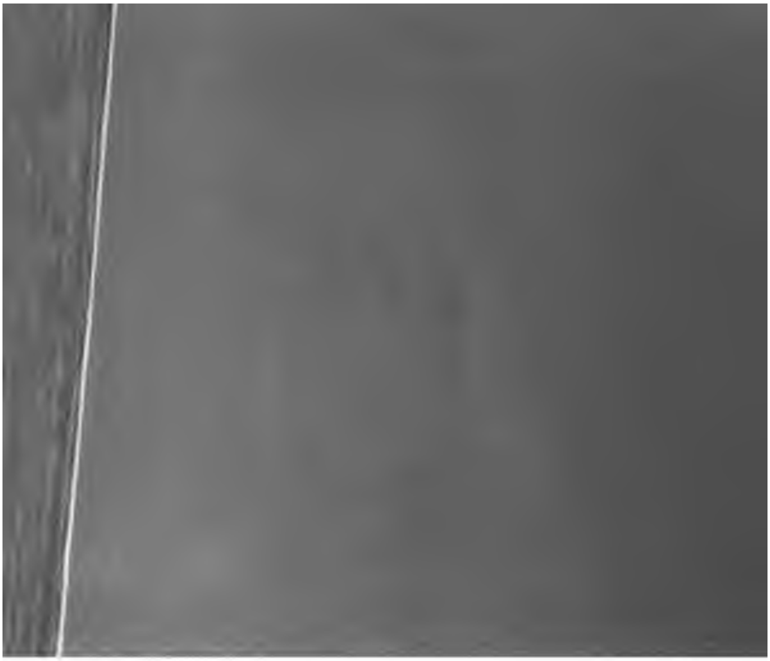
PROBLEM 10. The dimensions of a bin or box being given; to find how many bushels it will hold.

RULE. Multiply the length, in inches, by the breadth, and that product by the depth, and divide the last product by the solid inches in a statute bushel, (2150.425 inches) the quotient will be the answer.

PROBLEM 11. To find the tonnage of a ship.

RULE. Multiply the length of the keel in feet by the breadth of the beam, and that product by the depth in the hold, and divide the last product by 95, the quotient is the tonnage.

FINIS.



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